APRIL 1960

Precision Metal Molding

INCLUDING DIE CASTINGS MAGAZINE

UNIVERSITY MICROFILMS
313 N FIRST ST
ANN ARBOR MICH
P1Z

NINTH ANNUAL

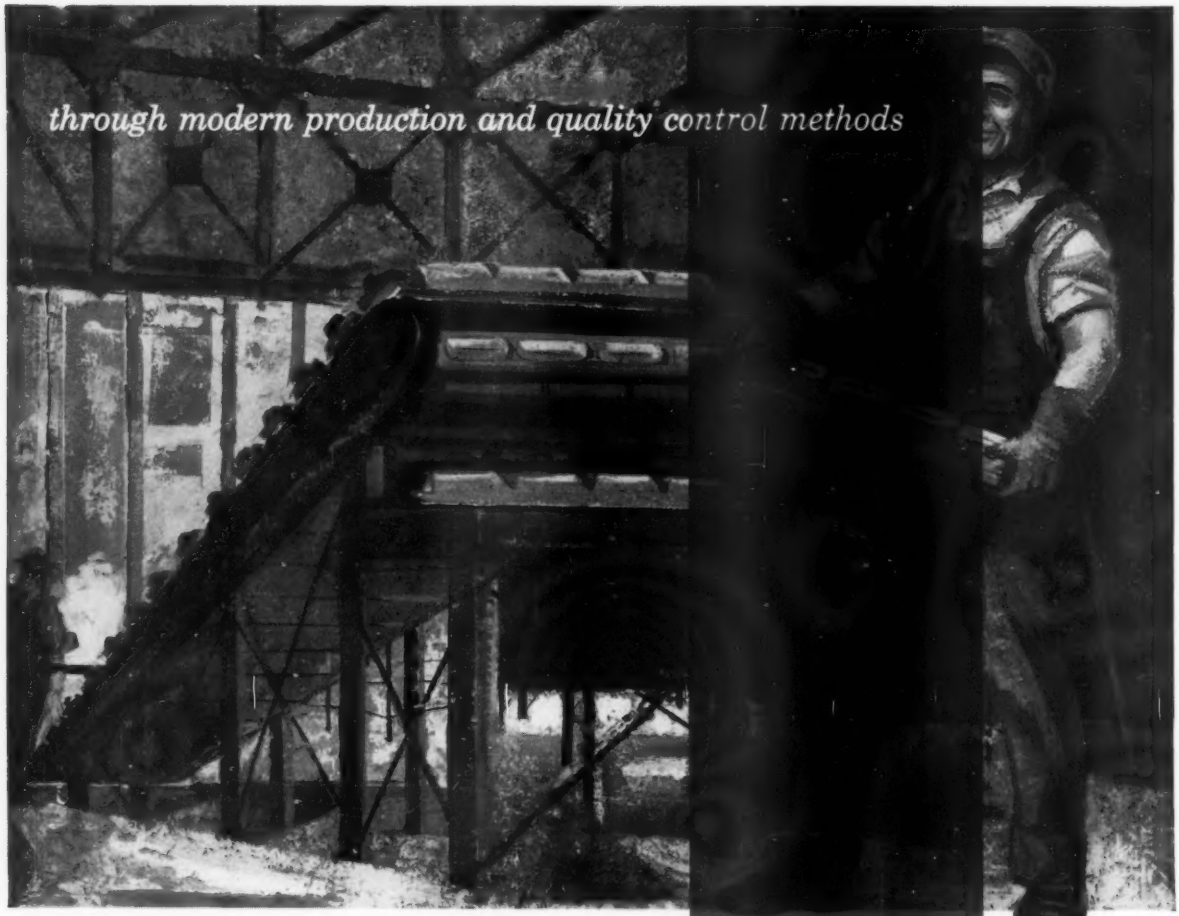
POWDER METALLURGY DIRECTORY

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

PMM

The magazine for design, finishing and the use of:

SINTERINGS • INVESTMENT CASTINGS • EXTRUSIONS
PLASTER MOLD CASTINGS • SHELL MOLD CASTINGS
PERMANENT MOLD CASTINGS • DIE CASTINGS



UNIFORM HIGH QUALITY

ZAMAK

ZINC BASE DIE CASTING ALLOYS

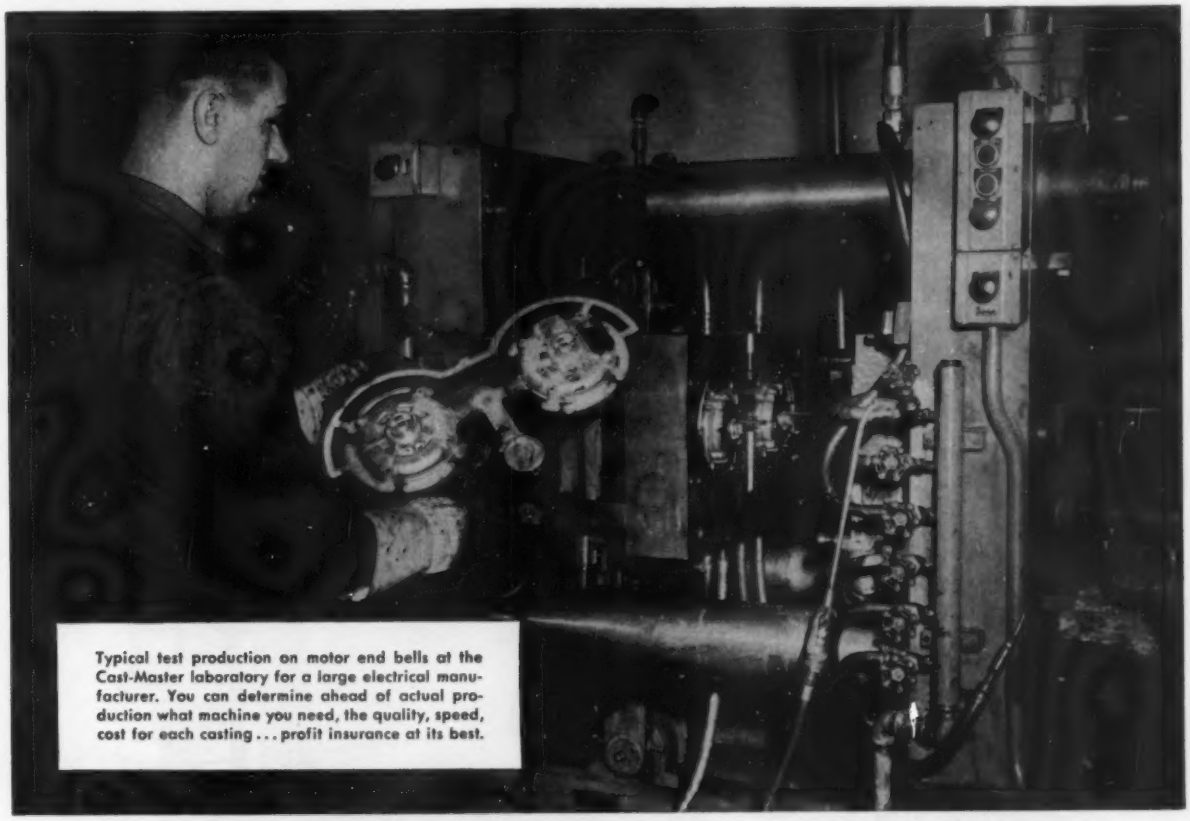
Uniformity and purity of Certified Alloys Zamak is rigidly controlled by modern inspection and testing methods to meet customers specifications. Ingots are free of gas and impurities to assure fast trouble-free productions, sound castings and minimum scrap loss.

Fast, dependable delivery is assured by high speed production techniques. All shipments are palletized for handling ease and shipped with a certificate of analysis.

CERTIFIED ALLOYS Company

DETROIT, MICHIGAN — P. O. Box 4014 — Telephone: VErmont 7-3350
INDIANAPOLIS, INDIANA — 3757 N. Meridian — WAlnut 3-9259
LOS ANGELES, CALIFORNIA — 9323 Bermudez Street, Rivera, California — telephone: OXford 9-9610

Circle No. 18 on Reader Service Card



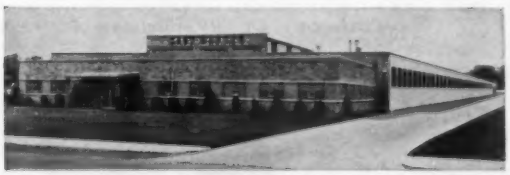
Typical test production on motor end bells at the Cast-Master laboratory for a large electrical manufacturer. You can determine ahead of actual production what machine you need, the quality, speed, cost for each casting . . . profit insurance at its best.

DIE CASTING PROFIT INSURANCE

Know The Quality, The Quantity and The Cost of Your Die Castings With Cast-Master's Simple Test Plan

Using your dies, and your materials, it is possible to make tests and die try-outs at Cast-Master's modern plant in Bedford, Ohio. Here's your advantage: Without investment in new machines, using the dies and material you plan to put into production, you can pre-test your die castings thoroughly. Cast-Master has the test lab, and there is no obligation. You have only to call to get complete information and arrange for an appointment.

The Cast-Master line includes 100-ton to 2000-ton models with a variety of interchangeable features for the most demanding hot or cold chamber jobs. It's the die casting line that gives positive mechanical toggle clamping, an efficient simplified hydraulic system, fast die set-up and a host of other production advantages you profit by using. Now, you can prove it without cost. For complete information on how to use the Cast-Master Lab Test Plan, call or write today.



This modern 72,000 sq. ft. Cast-Master plant in Bedford, Ohio, (Cleveland suburb) houses the finest machine tools and equipment for machine manufacture. Good transportation and close-by hotel accommodations will make your visit to Cast-Master a pleasant one. We'll be happy to make all arrangements for your stay.

H-P-M DIVISION-KOEHRING COMPANY

CAST-MASTER H28

23901 AURORA ROAD, BEDFORD, OHIO

Circle No. 41 on Reader Service Card

QUALITY CONTROL

of your specific alloy...

Foundry furnaces throughout the country pour liquid aluminum made to exact specification by A & M. Rigid quality-control guarantees the high standard of product that has made A & M a leader for over 20 years. Be sure your products are made from the best basic alloy—A & M.

Producers of Quality Aluminum Alloy Since 1938

ALUMINUM and MAGNESIUM, INC.

1 HURON STREET • P.O. BOX 720 • SANDUSKY, OHIO • TELEPHONE: MAin 6-4610

P.O. BOX 156 • Corona, California • Telephone: REdwood 7-2922

Circle No. 7 on Reader Service Card

IN THIS ISSUE

April, 1960: Volume 18 Number 4

FEATURE ARTICLES

31 CAST IRON TO CAST ALUMINUM
The possible accuracy and the complex shapes which can be cast are the prime reasons for using permanent mold castings.

32 HOW BULOVA SOLVED A HIGH TOOLING CHARGE
Complex shapes, light weight, thin wall sections, and limited production dictated plaster mold aluminum castings.

34 AN EXTRUDED CABINET-DOOR FRAME
The intricate shapes possible in aluminum extrusions make them better, less expensive, and simpler to assemble than rolled stainless steel shapes.

36 HOW TO SPECIFY POWDERED METAL PARTS
If you know how to specify powder metal parts, all of your vendors will bid on exactly the same part and the parts you get will fit your product.

40 A SINTERING TAKES A BIG LOAD
Don't be afraid to use sinterings under load. They can be designed for your specific service requirements.

42 THE LARK AND THE PMM PROCESSES
To keep costs down and styling up, Studebaker-Packard Corp. uses many parts made by the PMM Processes on the Lark.

44 FAIL SAFE HIGH PRESSURE VALVE BODIES
On aircraft fire fighting equipment component failure may mean loss of many lives and loss of the aircraft. That's why investment castings are used in critical places.

46 VACUUM DIE CAST ALUMINUM PARTS
Both shapes and alloys which can not be cast now may be possible with vacuum die casting of aluminum.

49 THE GENESIS OF A MACHINE PART
From wrought bar stock to a steel extrusion to a steel investment casting is the story of a part. Each change showed a manufacturing cost saving.

50 DESIGN TIPS
If machining of magnesium castings and extrusions has been troublesome, here are some tool sharpening tips which will make the work easier and better.

FINISHING SECTION

55 PORCELAIN ENAMELING ON ALUMINUM
Both extruded and cast aluminum can be porcelain enameled for either decorative or functional purposes.

59 INSITU BRAZING
Powder metallurgy gives a new type of brazing with improved mechanical properties. This should be most useful for special purpose brazing jobs.

DIRECTORY SECTION

63 NINTH ANNUAL POWDER METALLURGY DIRECTORY

65 PRODUCT DIRECTORY—alphabetical listing of companies by product manufactured. Containing listings of component fabricators, powder suppliers, and equipment manufacturers.

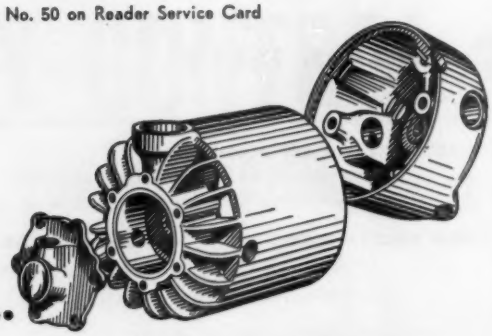
77 BUYER'S GUIDE—alphabetical listing of fabricators, powder suppliers, and equipment makers with addresses.

DEPARTMENTS

10 Casting About
14 New Products
18 Letters
24 Useful Literature
27 Industry News
105 Opportunities
106 Data in Ads

Circle No. 50 on Reader Service Card

It takes "More Than a Machine" to Produce GOOD Die Castings...



and MILWAUKEE has what it takes!

Among other needed factors, it takes a staff of trained die casting engineers . . . skilled die designers . . . die builders . . . machine operators . . . plus an intimate knowledge of the die casting process, its limitations and possibilities. Most important, it takes the kind of *know how* acquired only through years of specialization in the design and production of die castings in many shapes and sizes for thousands of different applications.

A pioneer of the die casting industry, Milwaukee offers everything you need for the production of fine die castings . . . completely modern plant facilities . . . highly skilled technicians . . . and more than 50 years of continuous service to die casting users throughout industry.

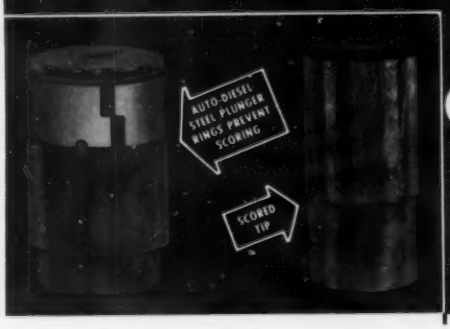
Milwaukee operates under the Certified Zinc Plan of the American Die Casting Institute.

Milwaukee has a separate plant for the production of Lead and Tin Die Castings.

MILWAUKEE DIE CASTING COMPANY
4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN
Established 1909

A 7237-⅛

NEW TIP & RING PLUNGER COMBINATION



6 MONEY SAVING ADVANTAGES

1. Longer wear
2. Denser castings
3. Eliminates aluminum pick-up on sleeves
4. Reduces tip changing down-time
5. Eliminates buying or making new tips
6. You can salvage and use your old tips

Greater Efficiency

Solves problem of scored or worn tips—saving thousands of dollars per year for the die casting industry.

Beryllium copper and steel plunger rings on piston tips result in maximum service life.

Catalog on Request

Plus—Auto-Diesel now offers stainless steel liners for goosenecks—increasing present life 4 to 1—literature on request.

THE AUTO-DIESEL PISTON RING CO.
3141 Superior Avenue • Cleveland 14, Ohio

Circle No. 11 on Reader Service Card

Precision Metal Molding®

published monthly, copyright 1960 by
THE INDUSTRIAL PUBLISHING CORP.

Editorial and executive offices: 812 Huron Rd., Cleveland 15, O.

IRVING B. HEXTER ..... *president*
LESTER P. AURBACH .... *executive v. p.*
EDWIN M. JOSEPH ... *1st vice president*
E. J. HEXTER ..... *vice president*
LEE HAAS ..... *vice president*
CHARLES F. GEYER ..... *vice president*
N. N. GOODMAN, JR. .... *vice president*
PAUL ROLNICK ..... *vice president*
ALAN J. KICHLER ..... *ass't. sec'y-treas.*

STAFF

David W. Veit ..... *publishing director*
Philip R. Kalischer ..... *editor*
Ronald Khol ..... *assistant editor*
Scholer Bangs ..... *western editor*
672 So. Lafayette Park Pl.
Los Angeles 57, California
Henry Lefer ..... *eastern editor*
Rm. 835, 60 E. 42 St.
New York 17, N. Y.
Alaric Mausser ..... *art director*
N. G. Kiser ..... *circulation manager*
R. V. Black ... *mgr. reader service dept.*

SALES OFFICES

Cleveland 15
812 Huron Rd., SU 1-9620
ROBERT SIMMONS

New York City 17
Rm. 835, 60 E. 42 St. MU 7-3420
LEE HAAS *manager*
ARTHUR L. GOEBEL

Chicago 11
Rm. 704, 520 N. Michigan,
WH 3-1655
CHARLES F. GEYER *manager*
KENNETH L. JONES

Los Angeles 57
672 S. Lafayette Park Pl.,
DU 7-5104
ALAN T. CAZIER *manager*
LLOYD BROOKMYER

London, S.W. 1
31 Palace St., Westminster,
VI 2608
JOHN A. LANKESTER *manager*

SUBSCRIPTIONS in U.S. and possessions: $7, 1 year; $12, 2 years. Canada: $8 per year. Foreign: $10 per year, payable in advance in U.S. funds. U.K.: £ 3.5.0 per year payable in Sterling to London office. Single copies, when available: 1 to 10 — $1.00 each; 11 to 25 85¢ each; over 25 75¢ each.

AFFILIATED PUBLICATIONS: Applied Hydraulics & Pneumatics. The Refrigeration & Airconditioning Business, Material Handling Engineering, Material Handling Illustrated, Modern Office Procedures, Occupational Hazards, Power Transmission Design, Welding Design & Fabrication. Member BPA.

Accepted as a controlled circulation publication at St. Joseph, Michigan. Not responsible for unsolicited editorial material. Please return Forms 3579 to 812 Huron Rd., Cleveland 15, Ohio. Printed in the U.S.A.

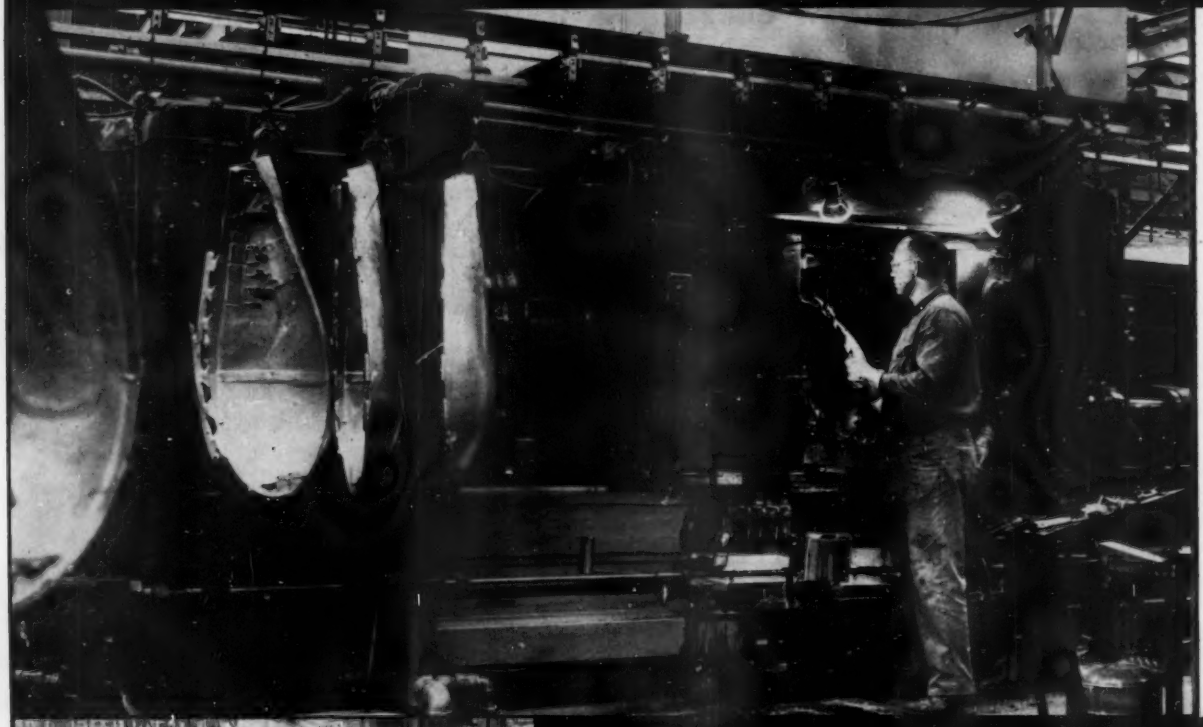
Casting research on 17-4PH increases elongation 10% . . . costs Cannon-Muskegon customers nothing ¶ Cannon-Muskegon research has developed certain procedures for investment casting of 17-4PH that assure, consistently, the high level of properties which this alloy is capable of producing. ¶ Casting test bars in a keel block arrangement as shown here—rather than an end-gated arrangement—is one of them. Special recommendations on aging time and temperature are another. ¶ Further, Cannon-Muskegon research has demonstrated the necessity of stricter limits to provide a balanced chemistry and prevent harmful effects induced by too high or too low a content of certain elements. Keeping within these limits and following Cannon-Muskegon recommendations assures investment casters of consistently obtaining optimum performance from this fine alloy. ¶ We invite you to write for a free copy of the ICI Technical Research Report, "The Effect of Aging Time and Temperature on the Mechanical Properties of Investment Cast 17-4PH."

MASTERMET
AIR-MELTED ALLOYS

CANNON-MUSKEGON CORPORATION
Metallurgical Specialists • 2871 Lincoln Street • Muskegon, Michigan

Circle No. 15 on Reader Service Card

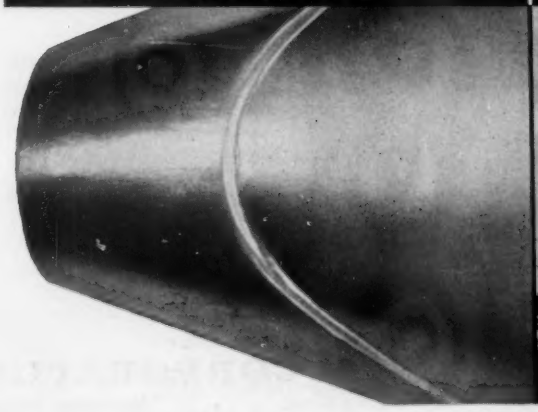
These photographs tell a....



Raw castings from 1000 ton Lester are entirely flash-free

50 castings per hour are automatically ladled and removed by conveyor take-off.

G.E. M-400 Luminaires at G.E. plant parking lot.



Closeup of assembled unit, showing two main castings and acrylic refractor.

Sensational Die Casting Story!

General Electric Produces Biggest, Thinnest Flash-Free Commercial Die Casting Ever Made...On 1000 Ton LESTER

The parts in the installation photo at the left are aluminum die castings, untouched and untrimmed. *They are completely flash-free!* The projected area including the biscuit, runners and overflow wells is 576 sq. in. The wall thickness is only .090". The part is the upper housing of the G.E. Mercury Luminaire, for outdoor lighting. Here's the kind of casting that really tests the ability of a machine to hold its full rated clamping tonnage.

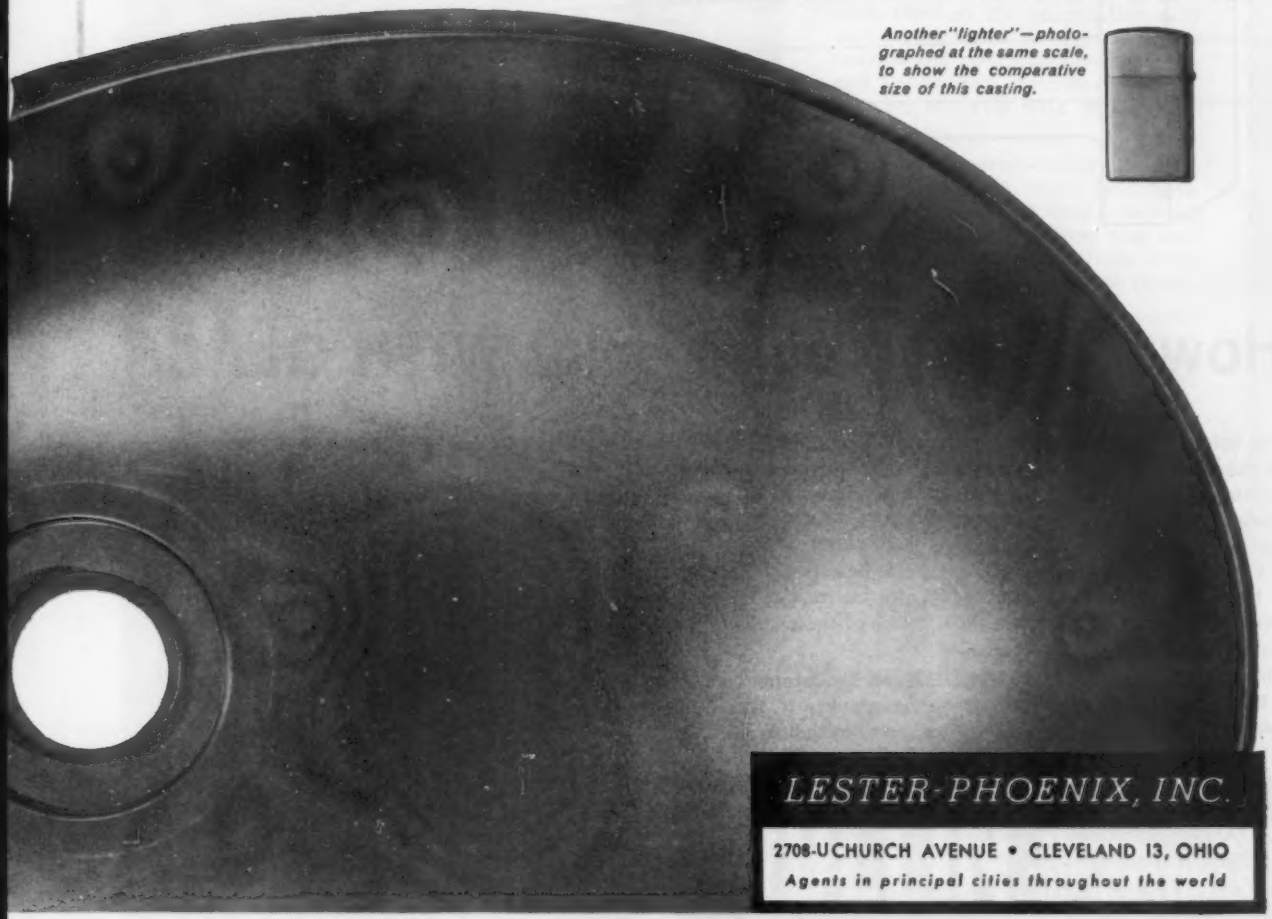
To flow the metal properly through such a thin section, over such a broad area, and to achieve high "as cast" finish qualities, demands a high plunger speed and maximum metal temperatures. As a result, the effective fluidity of the metal is close to 80%. This taxes the clamping capacity of the machine to its limits. How does the Lester HP-3½X-40C-SF perform? Let Mr. E.W. Denison, Manager- of Manufacturing Engineering at the G.E. plant in Hendersonville, North Carolina, give the answer:

"Two weeks after receiving this 1000 ton machine, we were able to ship the finished product to our customers. This record was made possible by Lester-Phoenix fine field service and the superb design and quality of this machine. The rugged die locking mechanism has enabled us to utilize the full 1000 ton locking pressure, thereby permitting us to produce the world's largest die casting."

The risk of giving away tons of aluminum from so-called "normal blow-back" is great in a part like this. Yet the record at G.E.—and at all other Lester installations—is assurance that Lesters have the guts to prevent flash and overweight castings.

Write for new Bulletin 102 with complete specifications on Lester Machines from 100 ton to 1600 ton capacity.

Another "lighter"—photographed at the same scale, to show the comparative size of this casting.

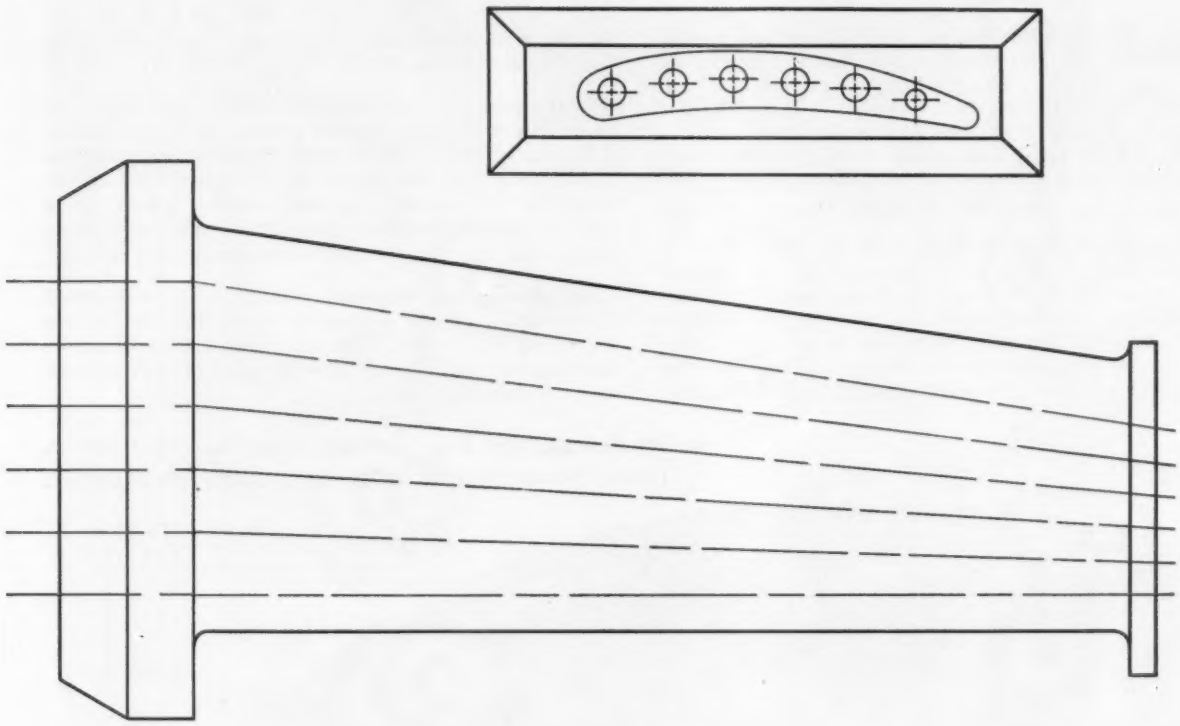


LESTER-PHOENIX, INC.

2708-U CHURCH AVENUE • CLEVELAND 13, OHIO

Agents in principal cities throughout the world

Circle No. 49 on Reader Service Card



How to make precise holes WITH GLASS

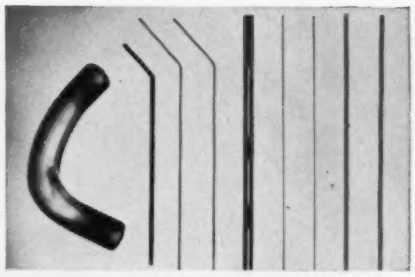
The holes in castings like this can be made with glass. It's a special VYCOR *brand* 96% silica glass we developed especially for metal casting.

You can use it as precision coring in high-temperature metal castings without having it melt or lose its shape. The exceptionally low expansion of the glass and its resistance to thermal shock make it possible to speed up the working cycle.

You simply put a tube of the right dimensions into your wax pattern. Send the pattern right into your mold production cycle. After casting is completed, the glass can be removed by leaching.

You can get the core surfaces either smooth or frosted. We can give equally tight tolerances on angles, curves, bends or any combinations of these.

Send for information sheet Write for number IC-6 for full line and specs, including stock wall tubing from 6 to 90 mm O.D. Address: Industrial Components Department, 47 Crystal Street, Corning, N. Y.



TOLERANCES on special core tubing run like this:

O.D.	TOLERANCE	BOW
.005 to .020″	.001″	.0006 in/in
.020 to .070″	.002″	.0006 in/in
.070 to .160″	.003″	.0006 in/in

Nominal O.D. to wall ratio is 3:1

CORNING GLASS WORKS

CORNING MEANS RESEARCH IN GLASS

Circle No. 21 on Reader Service Card

DOLLIN Die-casting Prices are LOW

because we produce *better* Die-castings!

Anyone can cut prices on die-castings by cutting corners on quality and services. But DOLLIN keeps prices down by exhaustively exploring every possibility to improve or simplify the design—make it more practical—reduce weight—add strength—combine parts—eliminate secondary operations—save on assembly and finishing costs.

DOLLIN gets the fullest potential out of every die-casting design and part, through the imaginative skill and experience of its engineers, die-makers and production craftsmen—and the modern machines and progressive methods with which they work.

For over a quarter-century, leading manufacturers in every field have found DOLLIN the ideal source for high-quality, high-volume zinc and aluminum die-castings, from large sizes down to fractions of an ounce.

Let DOLLIN help you get the most for your die-casting dollar. Submit prints or samples of parts for engineering advice and quotation, without obligation. Write for 16-page Facilities Brochure illustrating and describing Dollin's services, facilities and equipment.

RESEARCH PARTICIPANT

DOLLIN CORPORATION, 614 So. 21st St., Irvington 11, N. J.

Sales Offices: Boston • Buffalo • Canton • Chicago • Detroit Greensboro • Louisville • Memphis • Philadelphia • St. Paul

See "Yellow Pages" for nearest office.

DOLLIN Zinc & Aluminum DIE-CASTINGS

Circle No. 30 on Reader Service Card

CASTING ABOUT

technical news of applications & process involving precision metal molding

METALS FOR TOMORROW'S SPACE AGE VEHICLES

The high temperatures developed in large rocket motors requires entirely new metals and alloys. An entire family of these new alloys is under development by Aerojet-General Corp. and Stauffer-Temescal Co. They're alloys of tantalum and tungsten which, with the exception of relatively rare rhenium, have the highest melting point of any known metal.

The melting point of these alloys ranges between 5430° and 6150°F, the melting points of pure tantalum and tungsten.

A 90% tantalum, 10% tungsten alloy has an ultimate tensile strength of 150,000 psi at room temperature. At 4500°F this alloy still has a useful tensile strength of about 15,000 psi.

Success in the development of this alloy system is largely due to the development of the electron beam melting system. The exceptional purity imparted to the alloys by this melting system allows production of ingots which can be worked with conventional steel mill equipment and techniques. Machining can be done with standard tools. Scrap purity remains high enough to permit direct recycling to cut production costs.

Ingots up to 5"diameter and 42" long can be made and fabricated into forms or sheet as desired.

Along the same line, improved high temperature alloys, a report from General Electric Co. indicates that the addition of small amounts of yttrium to some of the common oxidation resistant alloys will greatly improve their properties.

A 25% chromium alloy (AISI type 446) with a small amount of yttrium added is as resistant to oxidation at 2500°F as the yttrium free alloy is at 2000°F.

The iron-chromium-yttrium alloy is readily cold-rolled, easily welded and should be a significant development in high-temperature metallurgy.

A fourth alloying element, either thorium or aluminum, added to the alloy still further improves the oxidation resistance. With only 3% aluminum added to the iron-chromium-yttrium alloy, an oxide coating is formed at 2600°F which is enamel-like, hard, non-chipping and thermally shock resistant. Welding and fabrication of this alloy are difficult.

SMELTERS ALUMINUM A BIG FACTOR IN THE ECONOMY

The importance of smelters aluminum was emphasized by the Aluminum Smelters Research Institute in a dramatic comparison of what would have been required if there had been no secondary aluminum produced. According to the report:

"Without the return of this salvaged aluminum during the past three decades, the duplication of this metal reserve would have cost the United States:

- 41-billion pounds of raw bauxite (this is more than the annual world production) and over one-billion pounds of alloying metals.
- 2000 ship voyages to carry the bauxite and other materials to the U.S.
- Two years of U.S. primary production at full current capacity.
- Enough electric energy to power the entire United States for eight weeks (more than 102-billion kilowatt hours).

Look at it another way, the 11-billion pounds of salvaged aluminum would build three-million six-room aluminum homes, and 57 B-52 bombers to boot."

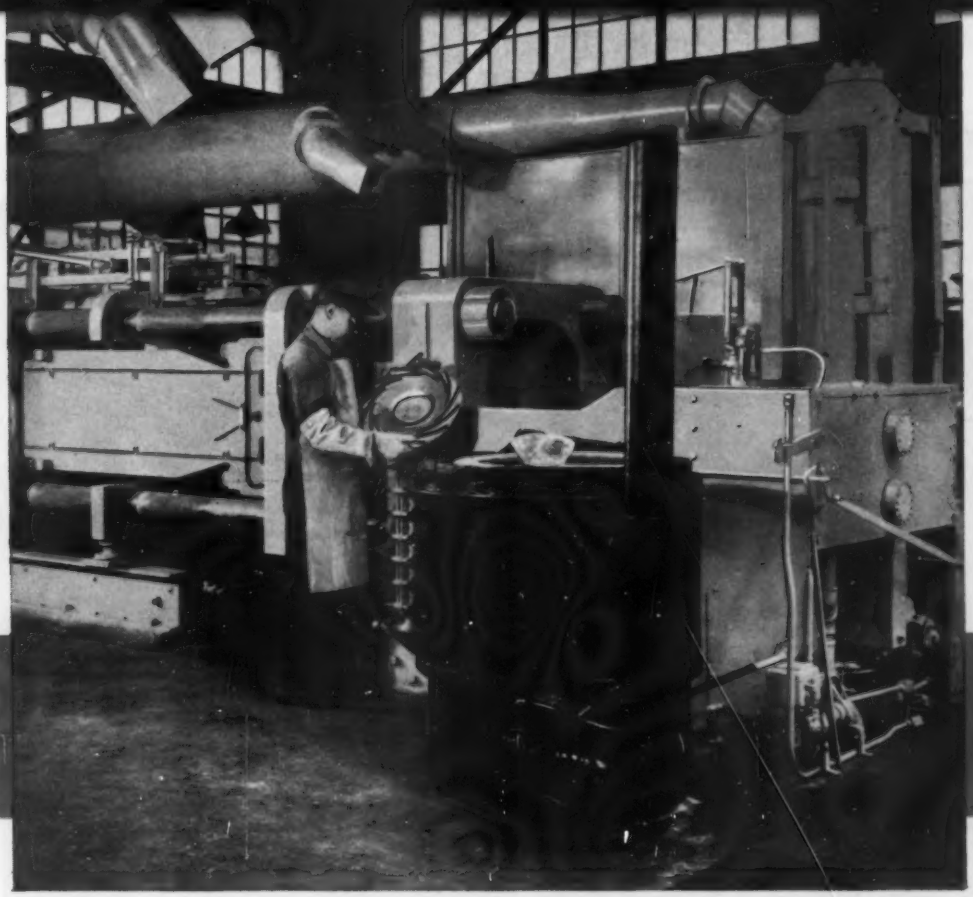
In 1952 federal government estimates were for 9-billion pounds consumption by 1975. Today the government economists are busy revising their figures up.

Today about 75% of the scrap aluminum (the smelters' raw material) is new scrap (scrap generated by fabrication). The old scrap (from obsolete products) is the balance. There will soon start a grand scale reversal and within the next 30 years over 50% of the total scrap recovered will be from obsolete products. By 1990, according to ASRI's Carl H. Burton total aluminum scrap available to the smelters will be about 2,175,000 tons. This will include 1,200,000 tons of old scrap.

COBALT ADDITIONS IMPROVE STAINLESS STEELS

Researches by the Cobalt Information Center indicate that the addition of from 1.5% to 10% of cobalt to some of the stainless steels increases the resistance to acid corrosion and, after proper heat-treatment, decreases the susceptibility to intergranular corrosion.

Investigations so far have been with steels containing 17% and 27% chrominum and 0%, 2%, and 9½% nickel and varying amounts of cobalt.



A 750-ton cold chamber die-casting machine at Alcoa's Garwood plant. Holding furnace in foreground containing molten metal is close to pressurized hydraulic lines.

Cellulubes promote safety at Alcoa

where hydraulic lines at 3500 psi pass near molten metal

The danger of fire due to line breaks has been held to a minimum at Alcoa's Garwood Works. In die-casting operations, Aluminum Company of America uses Cellulube fire-resistant hydraulic fluids in the hydraulic system serving the die-casting machines.

Although there have occasionally been line breaks under pressures ranging up to 2,000-3,500 psi, no serious fires have ever resulted. Alcoa has found that Cellulubes not only perform well as hydraulic fluids, but provide excellent lubrication of pump parts.

Cellulubes, the *safe* hydraulic fluids, are available in six controlled viscosities: 90, 150, 220, 300, 550 and 1000 SUS at 100°F. You can select the viscosity best suited to your operations. Cellulubes may well make an important contribution to the safety of your plant and personnel. Write to us for more information about Cellulubes. If you'd like a sample for evaluation, please let us know what application you have in mind.

Celanese® Cellulube®

Celanese CHEMICALS

CELANESE CHEMICAL COMPANY
a Division of Celanese Corporation of America
Dept. 589-D 180 Madison Ave., New York 16, N.Y.

Canadian Affiliate: Canadian Chemical Company Limited, Montreal, Toronto, Vancouver
Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16.

Circle No. 17 on Reader Service Card

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*

Careful addition of sulfur to melt guarantees typical sulfide distribution, as shown in photomicrograph of longitudinal specimen of EZ MACHINING tool steel.

Sulfur addition to melt held to narrow range in Allegheny Ludlum's EZ MACHINING GRADES

Uniform, finely-distributed sulfides mean uniform machining, uniform high finish, uniform long tool life order after order

Adding sulfur, actually an impurity, to a tool steel melt to make it free-machining must be done with care and precision. That's why Allegheny Ludlum maintains an extremely close average range in adding sulfur to its EZ MACHINING grades. But mere range, however narrow, is not enough. A-L has developed special techniques in adding sulfur and nucleating agents to produce the uniform, finely-distributed sulfides that characterize good free-machining tool steels.

A-L's extra care means you can standardize your machining operations from piece to piece and order to order. This reproducibility is reflected in uniform *machining;* uniform *high finish;* uniform *long tool life.*

For example, in the production of hobs these machining properties in Allegheny Ludlum's EZ MACHINING steels minimize the costly "backing off" operation for back clearance of multiple teeth, eliminating complicated extra heat treatment. Lower residual stresses are set up, because the steel has a lower resistance to the cutting action. Naturally, hobbing is only one of the situations where these free-machining characteristics can benefit you.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier. *ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Building, Pittsburgh 22, Pa. Address Dept.PM-28*

WBW-7250

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it

Circle No. 6 on Reader Service Card

These L.D.C. Aluminum Die Castings help keep a marine radar system on the beam

Indicator Unit of the new Sperry Radar 5. Control housing and indicator frame are L.D.C. corrosion-resistant aluminum alloy.

There's no guesswork with the new Sperry Radar 5, the navigating aid and anti-collision device for small boat operators. It enables the pilot to obtain relative bearings of other vessels and objects within range . . . allows the navigator to sight land falls . . . offers greater safety at night and during bad weather.

Reliability and diversity of the Sperry Radar 5 are made possible through modern design and precision engineering, sparked by complex and quality-proven parts . . . that include L.D.C. corrosion-resistant aluminum alloy die castings.

Latrobe Die Casting Co.
Latrobe, Pennsylvania

DISTRICT OFFICES:

AKRON, OHIO
E. G. Sims, Jr.
227 W. Exchange St.
Tel: Portage 2-7663

CLEVELAND, OHIO
William Kranz
20001 West Lake Road
Tel: Edison 1-6886

DETROIT, MICHIGAN
J. R. Lemon, Jr.
1016 Fisher Bldg.
Tel: Trinity 3-5910

NEW ENGLAND
R. L. Thomson
471 Glenbrook Rd.,
Glenbrook Station
Stamford, Conn.
Tel: Fireside 8-3985

BUFFALO, N.Y.
Harry W. Harding
235 Burke Drive
Tel: Amherst 1164

DAYTON, OHIO
J. M. Gallaher
363 West First St.
Tel: Baldwin 4-3523

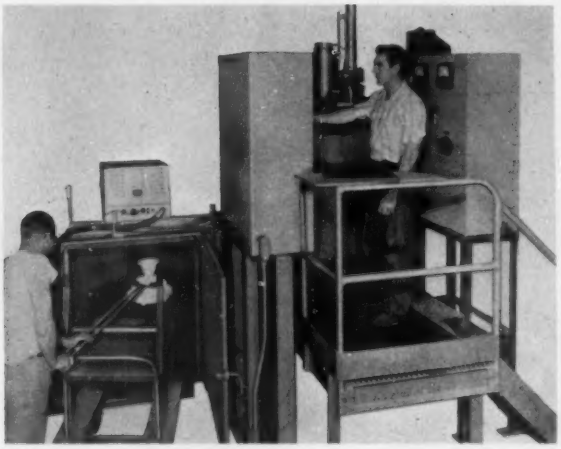
PHILADELPHIA, PA.
Albert B. Reid
505 Wadsworth St.
Tel: Chestnut Hill 7-8833

Established 1918

Circle No. 47 on Reader Service Card

NEW PRODUCTS AND DEVELOPMENTS

Qualified readers can get complete details on these products. Use the Reader Service Cards. You'll find them facing page 108 of this issue.



VACUUM MELTING AND CASTING FURNACE

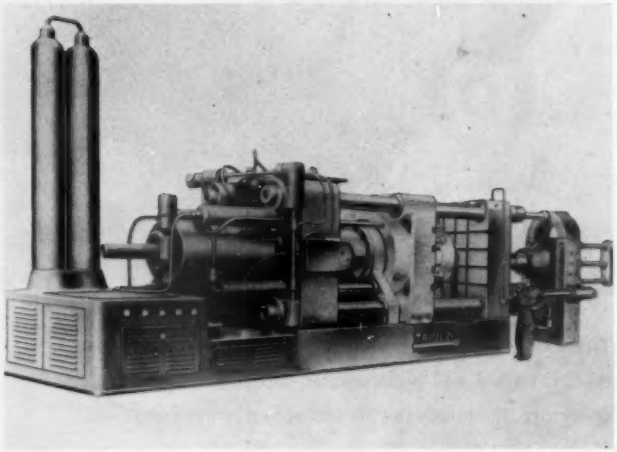
F. J. STOKES CORP.—The Model 437-523 induction heated furnace permits almost continuous vacuum melting and precision casting operations. The mold chamber (at the left) is located in line with the melting chamber. Molds are pushed from the mold chamber into the melting chamber through a lock to receive the pour. Then they are withdrawn without breaking the vacuum. The mold carriage can be fitted with a turntable to permit several molds to be poured from one crucible. A centrifugal casting device is optional. The furnace is supplied as a complete package and can be installed and operating in one day. This model has a capacity of 100 lbs. A 50 lb. capacity model is also available.

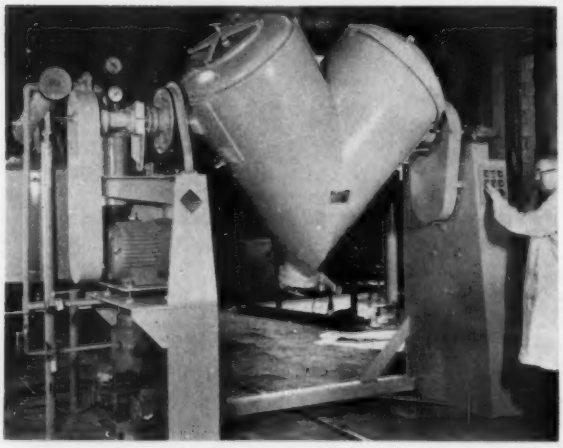
Circle No. 235 on Reader Service Card

110 LBS. OF ALUMINUM PER SHOT WITH NEW DIE CASTING MACHINE

A. TRIULZI—The Castmatic 2200 T cold chamber die casting machine has a locking force of 2500 tons. Capacities are 110 lbs. of aluminum, 198 lbs. of brass or 308 lbs. of zinc. Eight fully automatic casting schedules can be arranged on a pre-selector panel. Features include 72.8" x 51.2" useful platen size, 35 tons ejection force and 225 tons maximum injection force. Overall size is 54 x 12 x 18 feet. Total weight is 126.5 tons. Speed is 120 dry cycles per hour. The self-contained, oil-operated unit has push button operation. The machine is made in Italy.

Circle No. 68 on Reader Service Card





BLENDER-DRYER CUTS POWDERED METALS PROCESSING TIME

PATTERSON-KELLY CO.—The P-K Solids Processor prepares powdered metals for the press faster than conventional methods. Process time is changed from hours to minutes in some cases. Only two operations are required. First, the powder is blended, lubricated, and granulated. Then solvents are removed and recovered in the vacuum drying stage. This eliminates conventional blending by ball mills and the later addition of lubricant-bonding agents. Dry ingredients can be blended with dissolved wax in a continuous operation. The unit greatly reduces material handling and equipment requirements.

Circle No. 237 on Reader Service Card

continued on page 102

You get
speedier service
from the
ZINC ZONE

Central location of
American Zinc plants assures
prompt deliveries of slab zinc to
any point in the nation.

HILLSBORO, ILL., PLANT
Prime Western, Brass Special, Intermediate, High Grade, Continuous Galvanizing Grades
MONSANTO, ILL., ELECTROLYTIC PLANT
Special High Grade, High Grade, Continuous Galvanizing Grades, Special Shapes
FORT SMITH, ARK., SMELTER
Prime Western, Brass Special
DUMAS, TEXAS, SMELTER
Prime Western, Brass Special, Continuous Galvanizing Grades

PRODUCERS OF

ALL GRADES OF SLAB ZINC
ZINC ANODES (Plating & Galvanic)
METALLIC CADMIUM
SULPHURIC ACID
LEAD-FREE and LEADED ZINC OXIDES
ZINC CARBONATE
GERMANIUM DIOXIDE
AGRICULTURAL LIMESTONE
CRUSHED STONE

American Zinc Sales Company

Distributors for AMERICAN ZINC, LEAD & SMELTING COMPANY

Columbus, Ohio • Chicago • St. Louis • New York • Detroit • Pittsburgh

Circle No. 9 on Reader Service Card

DIXON AIR-SPUN Graphite

makes greater diversification of powdered metal parts possible.

STRENGTH & UNIFORMITY
Because of the uniform size of Air-Spun graphite, it flows readily when mixed with iron powders, and produces parts that are stronger and cleaner.

SPEEDS PRODUCTION
Dixon Air-Spun is readily diffused with iron powder in sintering processes which results in saved production time.

PUREST QUALITY
Refining of natural graphite is a closely supervised operation, as is the grinding and other processes, guaranteeing maximum purity of Air-Spun.

SEE THE DIFFERENCE FOR YOURSELF
Our field representatives are available to evaluate your specific requirements. Write today.

D X N TRADE MARK
EXCELLENCE SINCE 1827

Graphite & Lubricants Division

THE JOSEPH DIXON CRUCIBLE CO., INC. • Jersey City, New Jersey

Circle No. 28 on Reader Service Card

1960 DESIGN ENGINEERING SHOW &

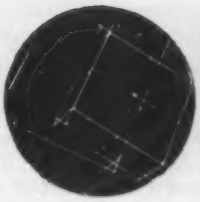
ASME CONFERENCE

New York Coliseum, May 23 to 26, 1960

Ideas to spark your thinking. *Applications* to help you create superior products. Knowledge, for better accomplishment. 400 of the nation's most imaginative materials and components manufacturers gathered under one roof to give a plus to your design and development planning. Exhibits are staffed with engineers. Compare first-hand — test — come away with hundreds of new ideas that can influence your product engineering for years ahead. You owe it to yourself to attend.

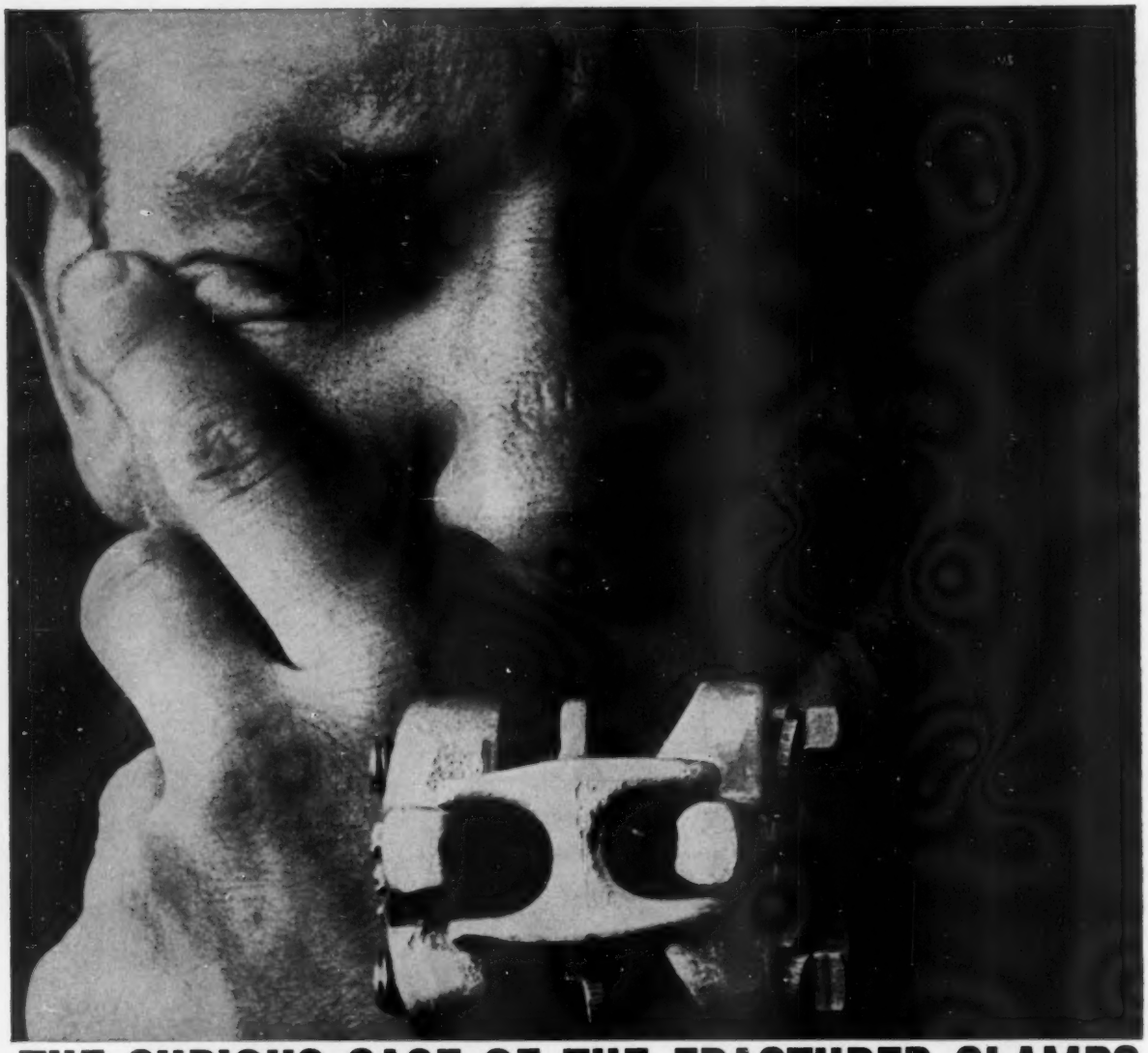
IDEA EXCHANGE: *The Design Engineering Conference sponsored by the Machine Design Division, American Society of Mechanical Engineers*

The *must* conference of the year for everyone involved in product design, research and development.



For information, write to Clapp & Poliak, Inc., Show Management, 341 Madison Avenue, New York 17, New York.

Circle No. 24 on Reader Service Card



THE CURIOUS CASE OF THE FRACTURED CLAMPS

Another costly mystery solved—by the man from Kaiser Aluminum

THE PUZZLING FACTS. A Kaiser Aluminum customer had been manufacturing an electrical connector clamp from a casting of primary standard 356 aluminum alloy. But—he often experienced difficulties due to cracking and breakage in use. What to do?

HOW THE CASE WAS SOLVED. After an on-the-scene check, the man from Kaiser Aluminum came up with the answer. His recommendation: use Kaiser Aluminum Alloy A-356, a *high purity* alloy specially developed to provide greater ductility and strength in just such castings as these. Result: a superior clamp that developed a reputation of reliability for the manufacturer—and much additional business.

WE LOVE A MYSTERY. This is one of many actual cases solved by Kaiser Aluminum working with a customer. Perhaps *you* have a mystery one of our engineers might help solve? He's ready to give you expert advice on any casting problem—including conversion from cast iron to aluminum, mold and die design, alloy selection, heat treatment, finishing, fluxing, metal transfer.

FULL ALLOY AVAILABILITIES. Kaiser Aluminum can supply you *fast* with a wide selection of casting alloys to suit any engineering requirement—from general purpose, low stressed alloys to alloys having good properties at elevated temperatures.

FOR PIG AND INGOT with a free sleuthing bonus, call your nearest Kaiser Aluminum sales office or any of the distributors listed on the opposite page. Or write to: Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, 300 Lakeside Drive, Oakland 12, California.

KAISER ALUMINUM*

THE BRIGHT STAR OF METALS

*Trademark Kaiser Aluminum & Chemical Corp.

See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult your local TV listing.

Circle No. 86 on Reader Service Card

FRACTURED?

Your Kaiser Aluminum ingot distributor is more than a nearby source for aluminum pig and ingot. He's ready to render specialized advice on anything from alloy selection to fabricating methods. And "Service" is his middle name!

CALL YOUR NEAREST

KAISER ALUMINUM*

INGOT DISTRIBUTOR:

BENTON HARBOR, MICHIGAN
Michigan Standard Alloys Sales Co., Inc.
WAlnut 5-2195

BUFFALO, NEW YORK
Samuel Greenfield Co., Inc.
HUMboldt 4050

CHICAGO, ILLINOIS
R. Lavin & Sons, Inc.
Virginia 7-1800

CLEVELAND, OHIO
Alloys & Chemicals Mfg. Co., Inc.
ONtario 1-8600

DETROIT, MICHIGAN
Alloys & Chemicals Mfg. Co., Inc.
WOodward 2-6414

FAIRFIELD, ALABAMA
W. J. Bullock, Inc.
STate 8-6586

GRAND RAPIDS, MICHIGAN
Liberman & Gittlen Metal Co., Inc.
GLendale 8-1361

HOUSTON, TEXAS
Gulf Reduction Corp.
WAlnut 6-2425

LOS ANGELES, CALIFORNIA
Aaron Ferer & Sons, Inc.
MAdison 5-1553

PHILADELPHIA, PENNSYLVANIA
George Sall Metal Co., Inc.
Pioneer 3-2828

WEST SPRINGFIELD, MASSACHUSETTS
New England Smelting Works, Inc.
REpublic 4-6491

*TRADEMARK KAISER ALUMINUM & CHEMICAL CORP.

PMM LETTERS

the readers' forum

OUR EUROPEAN READERS

We would be much obliged, if you could send us the address of the firm "Sun Oil". We are interested in their new non-flammable liquid "Sunsafe."

The article regarding "Sunsafe" was in your journal for September, 1959.—Dr. Kozler, Chemapol, Czechoslovakia.

The address, 1608 Walnut St., Philadelphia, Pa.—Ed.

We have read in PRECISION METAL MOLDING for December, 1959 a very interesting article about kitchenware made by your esteemed company.

Our factory is making die castings and kitchenware. The main line is our production of pressure cookers and electric frying pans. We have a sales organization in Austria as well as in Munich, Germany, where we have our own firm. Your products would just match in our production line and we would ask you if you are prepared to give us a license for the sales and manufacture of the food mixer and the can opener. A garlic press we are already making.

In the case you would be interested in co-operation for the European market we wish at first that you send us samples of your products and then we will produce them in Austria. Austria has production advantages in labor costs and metal prices.

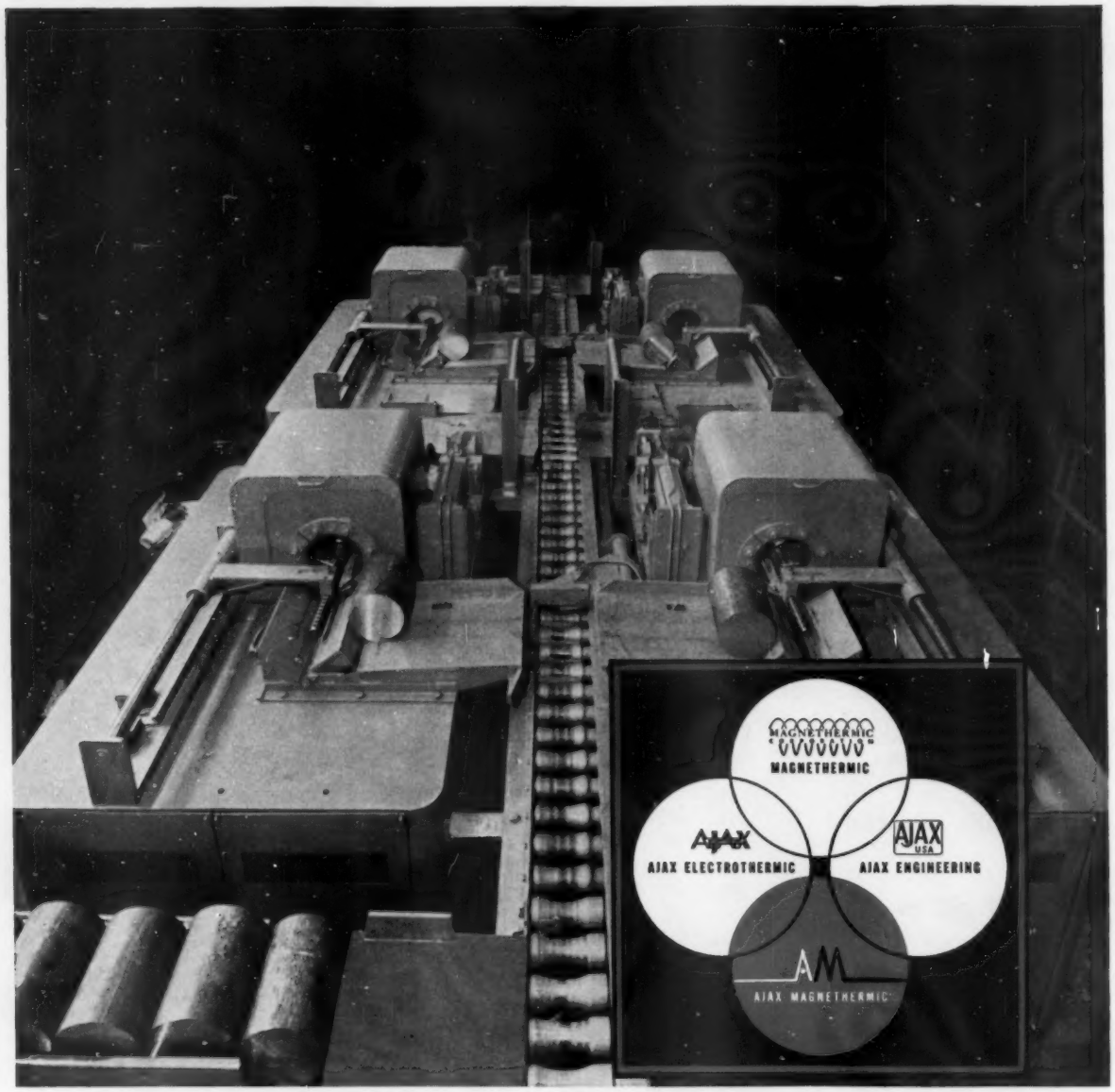
It might be that for the first few thousands we could borrow the moulds. There are many possibilities and of course we would appreciate it if one of your representatives would visit Vienna. Under separate cover we are sending you a booklet about Vienna to make the visit more attractive.

In any case please send us one sample of your mixer and your can opener.—Gruber & Kaja, Vienna, Austria.

This letter is one of several from this company who picked items from our December, 1959 issue on 20th Century Design and have asked for licenses to manufacture for the European market.—Ed.

MODEL NO. 301
COLOR FILL
• CODE MARK
• IMPRINT
your products, parts, caps, containers, etc. with the—
ACROPRINTER®
CRANE LINE
Tedious hand filling, messy spraying and sloppy applications of color . . . are eliminated when you use the ACROPRINTER®.
We make a flexible die of ACROPRENE® to exactly match the cavity, depression and contour of your part or product, then set it in the ACROPRINTER® No. 301 or No. 401A . . . making your color filling operation a high production mechanical one that applies printing ink or enamel precisely and attractively.
Die-Cast, stamped, embossed, molded, cast and engraved parts are accurately color filled with lettering and design.
BLOWER
®ACROPRINTER Model No. 401A
Model No. 301 is a hand operated machine adjustable for utmost perfection. Model No. 401A is the air-operated machine with that same precise touch and higher speed.
For FILLING or PRINTING, send a sketch, sample part or description with dimensions. Acromark Engineers will give you the full answer promptly, with illustrating data.
The ACROMARK Company
426 Morrell St., Elizabeth 4, N. J.
"The Original Marking Specialists"

Circle No. 3 on Reader Service Card



At Scovill Manufacturing Company, Waterbury, Connecticut, these four Ajax Magnethermic Induction Heaters heat 9" x 16" copper and brass billets for a 2500 ton extrusion press at the rate of 60 billets per hour. Each heater is rated 450 KW. The four heaters in tandem are served by a common loading and unloading conveyor.

THE NEW NAME WITH THE FAMILIAR RING!

60-Cycle Induction Billet Heaters manufactured by AM, one of our many products for induction heating or melting of all types of metals.

"induction heating is our only business"

Ajax Magnethermic CORPORATION

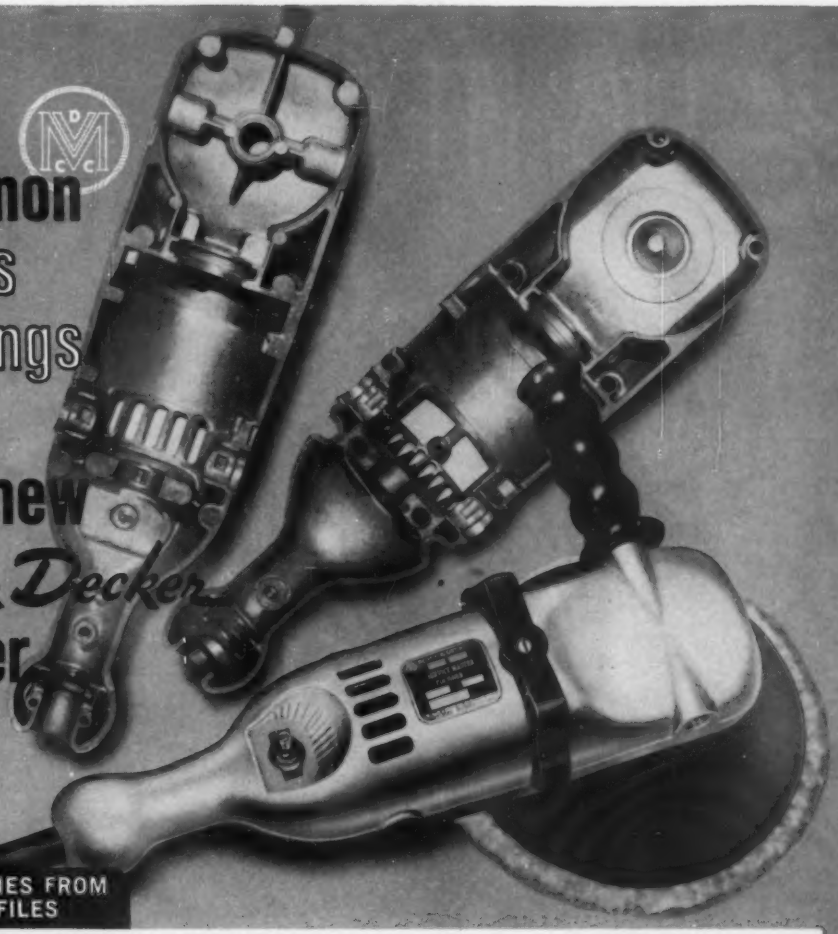
GENERAL OFFICES
P. O. BOX 839
Youngstown 1, Ohio

TRENTON DIVISION
930 Lower Ferry Road
Trenton 5, New Jersey

YOUNGSTOWN DIVISION
3990 Simon Road
Youngstown 1, Ohio

Circle No. 5 on Reader Service Card

Mt. Vernon reduces 5 castings to 2 in the new Black & Decker Polisher



CASE HISTORIES FROM MT. VERNON FILES

Subject:

The Black & Decker Manufacturing Company, TOWSON, MARYLAND

This new B & D "Servicemaster" Polisher—and its companion Sander, each of which sells for only $65. —contains outstanding features formerly found only in higher priced units: heavy-duty ball bearings; spiral bevel gears; recessed toggle switch, protected from dust; rugged lightweight aluminum housings.

Advanced design, which took into consideration most of the inherent advantages of high-pressure aluminum die casting, resulted in considerable manufacturing economies and an ultimate *low price tag.*

Conventional design on the regular B & D line uses 5 castings: 1-a gear case 2-a gear case cover 3-a main field case 4-a switch handle 5-a switch handle cover. In the new B & D design concept *5 parts have been combined into 2 clam-shell castings* which weigh only 2 pounds 3 ounces, a weight reduction of approximately 2 pounds over similar type polishers... the new complete "Servicemaster" polisher weighs only 8¼ pounds.

Fewer parts, however complex, mean reduction in secondary assembly operations. But despite intricate design...the superior skill of Mt. Vernon craftsmen has assured Black & Decker a steady supply of highest quality aluminum castings, economical, excellent fitting...excellently finished...requiring the least number of finishing operations.

Perhaps, like Black & Decker, you too have a cost problem. Product design with our assistance may be your answer. Let's talk it over. Just call your nearest Mt. Vernon sales representative for action.

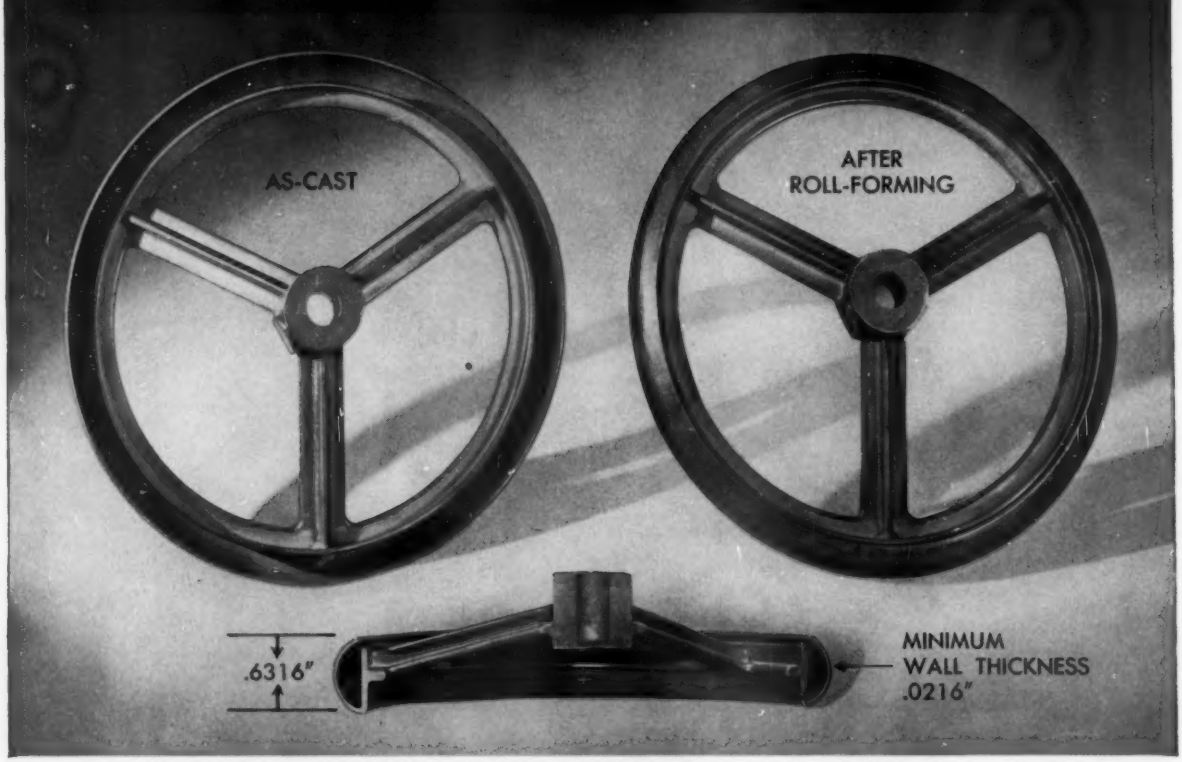
MT. VERNON DIE CASTING CORPORATION
STAMFORD, CONNECTICUT

SALES REPRESENTATIVES

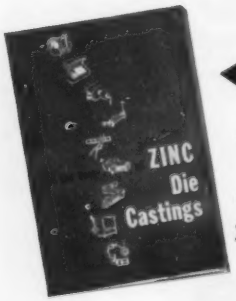
BALTIMORE, MD.: Mr. C. M. Gordon, 919 St. Paul St.
BROOKLYN, N. Y.: Mr. Robert V. Moore, 2317 Plumb 2nd St.
CLEVELAND, OHIO: Mr. Ernest Eller, 6 East 194th St.
GUILDERLAND, N. Y.: Mr. David H. King, 75 Willow St.
PITTSBURGH, PA.: Mr. Andrew W. Anderson, 300 Pasadena Drive So.
QUINCY, MASS.: Mr. Edmund W. Libby, 91 Merrymount Rd.
ROCHESTER, N. Y.: Mr. William Sauers, 101 Briarcliff Rd.
SKANEATELES, N. Y.: Mr. Jerome J. Theobald, 9 E. Genesee St.
STAMFORD, CONN.: Mr. Anker Anderson, Cascade Road
VALLEY FORGE, PA.: Mr. G. T. McMaster, P.O. Box 115

Circle No. 52 on Reader Service Card

IT'S LIGHTER THAN YOU THINK!



...HIGH DUCTILITY AND LOW COST WHEN DIE CAST WITH... ZAMAK



SEND FOR YOUR COPY TODAY

"THE END USES OF ZINC DIE CASTING"

Strength of this light-weight zinc die cast hand wheel is achieved by rigid, thin-wall sections. Cast in one piece with a U-section rim, the excellent ductility of ZAMAK allows forming at room temperature with one stroke of a high-speed press.

This low-cost roll-forming procedure, possible only with zinc die casting alloys, accounts for its wide use on many types of parts—handles, knobs, couplings, locks, etc.

And the smooth, as-cast ZAMAK surface, of course, allows low-cost plating or painting for almost any type of product.

HORSE HEAD® SPECIAL ZINC AND HORSE HEAD ZAMAK ARE PRODUCED BY

THE NEW JERSEY ZINC COMPANY

DEVELOPERS OF THE ONLY STANDARD ZINC DIE CASTING ALLOYS IN USE TODAY

160 Front Street · New York 38, N. Y.

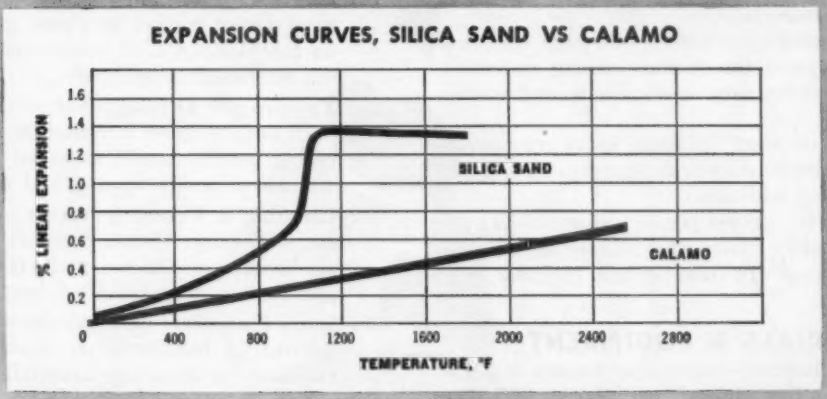
HORSE HEAD PRODUCTS ®

Circle No. 55 on Reader Service Card

Harbison-Walker

REFRACTORY MOLD MATERIALS

for metal casting



Calamo for Investment Molds

CALAMO, one of the extensively used Harbison-Walker products for molding is an alumina-silica refractory of optimum sizings for various molding mixtures. Its fusion point is 100°F. higher than that of normal silica sand mixes.

The chart above shows the exceedingly desirable expansion curve of CALAMO as compared with that of silica sand.

CALAMO, used as the major constituent of precision casting investment mixes, improves the dimensional constancy of the molds, makes them stronger and more resistant to erosion by metal flow. Investment costs are measurably reduced because an appreciably lesser amount of bonding agent is needed. This is attributable to the very desirable particle sizing and the equiaxed, dense grains of CALAMO.

CALAMO, used alone or as the major part of conventional dry sand molding mixes in rammed or in slinger-placed sand molds, provides not only the very desirable low thermal expansion characteristics particularly suited for precision casting but also provides the required refractoriness for melts and alloys melted at unusually high temperatures.

H-W Flintgrain for Ceramic Shell Molds

H-W Flintgrain is an alumina-silica refractory, similar in composition to CALAMO, having the same very desirable low thermal expansion characteristics, but greater angularity of grain shape.

The angular grain shape and optimum size distribution make H-W Flintgrain ideal for securing maximum compactness in the mold. It is used with special benefit for making ceramic shell molds and for similar applications in which dense, compact mold sections of greatest volume stability at all temperatures, are of paramount importance.

Illustration of angulate shape of H-W Flintgrain (x 3)

Write us for information regarding these and other Harbison-Walker products —mold wash materials—ceramic molding media—mold sand bonding clays.

HARBISON-WALKER REFRACTORIES COMPANY

AND SUBSIDIARIES GENERAL OFFICES: PITTSBURGH 22, PENNSYLVANIA

World's Most Complete Refractories Service

Circle No. 84 on Reader Service Card

USEFUL LITERATURE, CATALOGS, MANUALS

Qualified readers may obtain any of these technical publications free by circling the numbers on the Reader Service Cards facing Page 108

PROCESSES

145 **Die Casting**—CHICAGO WHITE METAL CASTING, INC. — Engineering data tells how to utilize modern zinc die casting techniques.

146 **Castings** — STEEL FOUNDERS' SOCIETY — 28-page booklet explains the use of steel castings as an engineering material.

147 **Castings** — BENDIX FOUNDRIES — 22-page technical booklet compares the various casting processes. Gives engineering data on aluminum and magnesium alloys.

148 **Sinterings** — MIDWEST SINTERED PRODUCTS CORP. — Illustrated brochure gives design data on sintered brass nuts and washers.

149 **Extrusions** — ALUMINUM CO. OF AMERICA — 32-page technical booklet shows what shapes are possible using the impact extrusion process. Includes engineering data.

MATERIALS & EQUIPMENT

150 **Die & Mold Repair** — MID STATES WELDER MFG. CO. — 4-page booklet shows how Model D27 Dot Welder alters or repairs dies and molds quickly and inexpensively.

151 **Tool Steel** — BETHLEHEM STEEL CORP. — Metallurgical data report on Cromo-W 55 tool steel for uses requiring high red hardness, toughness and wear resistance.

152 **Valves** — VACUUM RESEARCH CO. — Design and installation data on air operated vacuum gate valves.

153 **Die Components** — DETROIT MOLD ENGINEERING CO. —DME News gives specifications and prices on abrasive stones, standard mold base components and ejector pins.

154 **Titanium** — TITANIUM METALS CORP. OF AMERICA — 14-page technical booklet shows design considerations that required the use of titanium in current missiles.

155 **Resin Coated Sand** — AURORA METAL CO. — Information on Faskure resin-coated sand for shell cores and molds. It allows a 50% increase in production.

156 **Magnesium & Titanium** — BROOKS & PERKINS INC. — 40-page booklet gives extensive engineering data, design notes and finishing information on magnesium and titanium.

157 **Vacuum Gauge Control** — NRC EQUIPMENT CORP. — Information on an ionization gauge for measuring ultra-high vacuums.

158 **Toolholders** — WESSON CO. — 32-page technical booklet on toolholders for carbide inserts gives data on specifications, dimensions, applications and ordering.

159 **Bearings** — JOHNSON BRONZE CO. — 8-page facilities brochure shows research facilities, sales-engineering services and how bearings and bushings are made.

FINISHING

160 **Chromium Plating** — NATIONAL FILE CO. — 4-page brochure gives specifications on Krome-King units for low cost precision chromium plating of tools and gauges.

161 **Vibratory Finishing** — ALMCO, QUEEN PROD. DIV., KING-SEELEY CORP. — Brochure gives specifications on the Model VT-72 Vibrasheen vibratory finishing machine for metal parts.

162 **Tapping & Drilling** — BECKETT-HARCUM CO. — 7-page catalog gives information and specifications on air and hydraulic powered drill press feeds and air powered tapping and drilling machines.

163 **Cleaning & Finishing Agents** — OAKITE PRODUCTS INC. — 17-page "Oakite News Service" shows the application of Oakite products for the cleaning and surface preparation of metal parts.

164 **Screw Fasteners** — REYNOLDS METALS CO. — 48-page technical handbook on standard and special fasteners for aluminum assemblies.

165 **Automatic Tools** — BUCKEYE TOOLS CORP. — 8-page booklet gives engineering data on tools for low cost automatic drilling, tapping and fastening.

166 **Burnishing Media** — ABBOTT BALL CO. — 4-page Bulletin AP-1 gives specifications on steel burnishing media. Also describes a line of ball bearings and decorative steel shapes.

167 **Metallizing Coatings** — BEE CHEMICAL CO. — 45-page booklet describes the application of base, top and back-up coatings for the vacuum metallizing process.

168 **Welding Aluminum** — REYNOLDS METALS CO. — 32-page booklet covers arc, inert-gas, straight polarity and other types of welding for aluminum.

169 **Infrared Heating** — FOSTORIA CORP. — 20-page booklet describes the principles, advantages and applications of infrared heating. Shows typical standard systems.

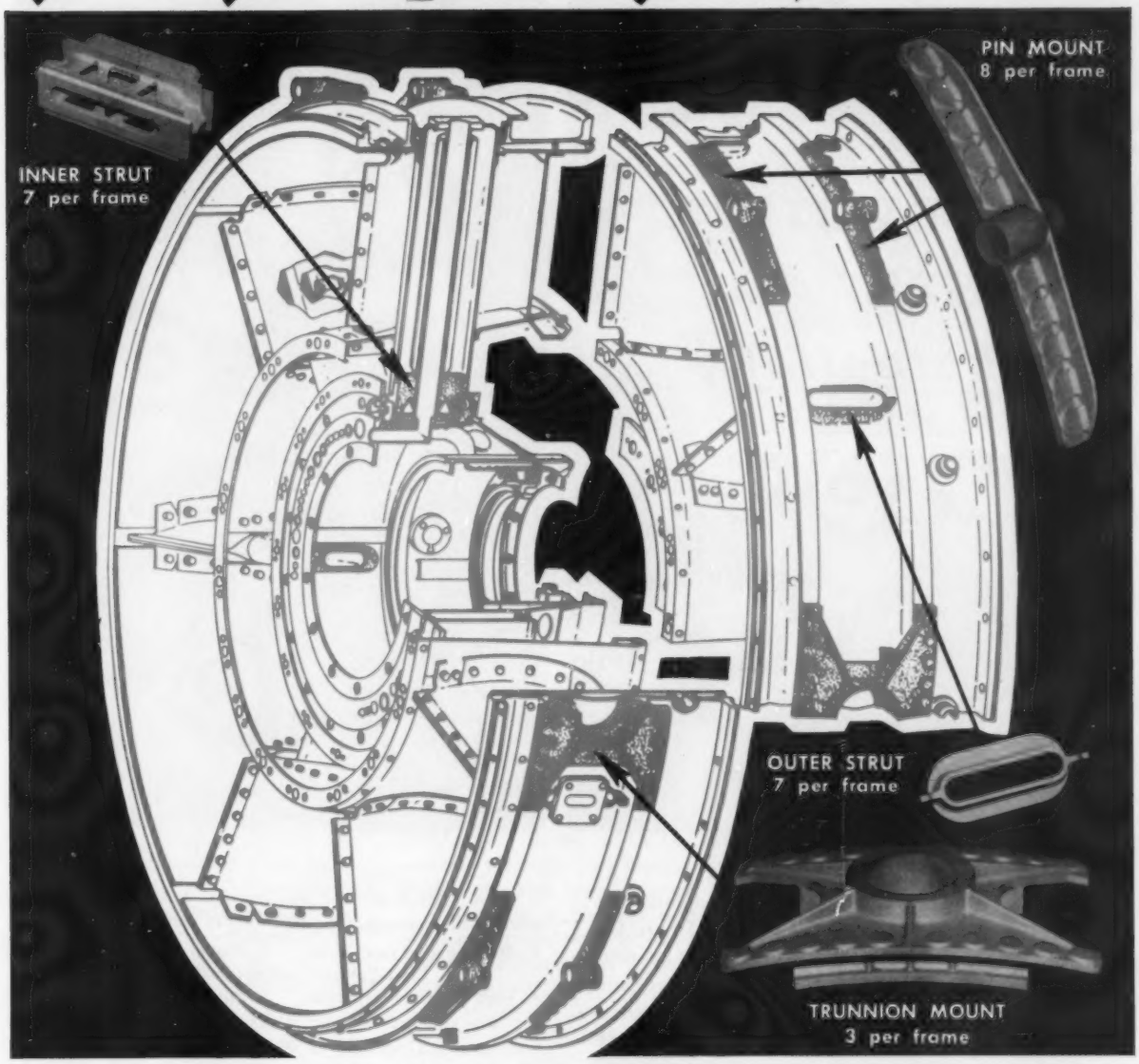
170 **Plating**—UDYLITE CORP.—10-page brochure lists the prices of a complete line of plating supplies.

171 **Adhesives**—MINNESOTA MINING & MFG. CO.—16-page technical booklet gives information on Scotch-Weld adhesives, structural adhesive design, joint design and bonding methods.

172 **Barrel Finishing**—TUMB-L-MATIC, INC.,—Technical bulletins describe methods for using barrel finishing to get specific results.

173 **Abrasives**—BRIGHTBOY INDUSTRIAL DIV.—16-page booklet on rubber bonded abrasives includes information on grains, textures, sizes, methods and applications.

174 **Zinc Finishing** — MITCHELL-BRANFORD CHEMICAL CO. — Processing instructions for producing a glossy black finish on zinc with Zinc Black D.



MONO-SHELL castings of A-286 Alloy, poured by DOUBLE-V System, MEET GENERAL ELECTRIC'S REQUIREMENTS for the J79 Engine's Ruggedized Turbine Frame!

Part drawings by Misco, evaluated on-the-spot by General Electric, permitted expedited tooling, production to meet required metallurgical quality, and delivery of castings in record time. These four castings are a vital part of the Turbine Frame of the J79 Engine, which powers the Navy Grumman F11F-1F, USAF Convair B-58, USAF Lockheed F-104, Navy North American A3J, Navy McDonnell F4H, and the CJ-805 Engine which is a commercial version of the J79 design for powering the Convair 880 . . . . . *Send us your inquiries, details of your requirements, or parts for quotation.*

Misco Precision Casting Company

Plants in
WHITEHALL, MICHIGAN
MUSKEGON, MICHIGAN

MISCO

Address inquiries to
122 Gibbs Street
WHITEHALL, MICHIGAN
TWinoaks 3-1515

MONO-SHELL

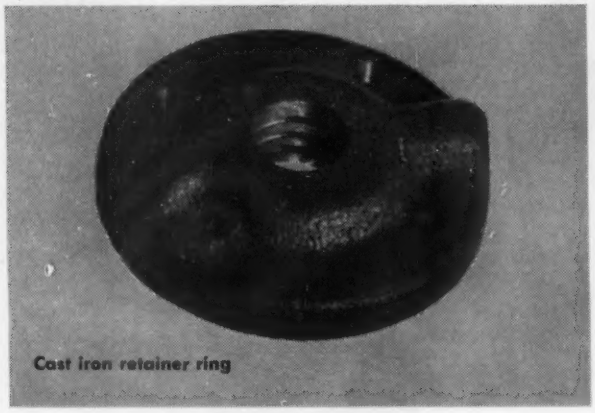
Sales Offices in Principal Cities

PRODUCERS OF AIRCRAFT AND INDUSTRIAL INVESTMENT CASTINGS

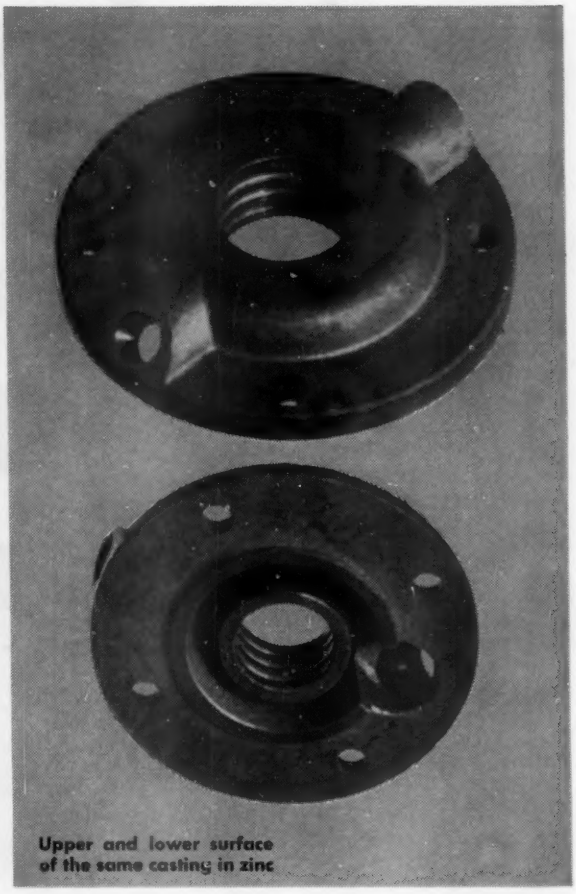
Circle No. 51 on Reader Service Card

Switch To ZINC DIE CASTING

From Cast Iron CUTS PRODUCTION COSTS *Substantially*



Cast iron retainer ring



Upper and lower surface of the same casting in zinc

Eliminate costly machining operations. Improve your product. That's precisely what St. Louis' Baldor Electric Co. did when they switched to zinc alloy die castings for their electric motor bearing lock rings.

Formerly the rings were sand cast in iron. To complete each ring required four machining operations: 1. Face milling; 2. Machining of a locating ring groove; 3. Boring a shaft hole; 4. Drilling screw holes. Other disadvantages of the sand castings included dimensional inaccuracy, rough appearance and a high reject rate due to porosity.

The switch to zinc die castings brought advantages which more than offset the difference in cost of basic material:

1. Elimination of machining. 2. Higher speed of production. 3. Close "as cast" dimensional tolerances. 4. High corrosion resistance. 5. Superior appearance.

The rings are die cast to exact size, with the bore holes and locating rings held to .002". The cored screw holes are cast to size in the same operation. They are cast in three sizes by the A. B. Mueller Co. of St. Louis, Mo. Each size is cast in a two-cavity die as annual production requirements are 36,000 of each size at the rate of 160-180 shots per hour.

DIE CASTING is the Process . . . ZINC, the metal . . .

BUNKER HILL

Eastern Sales Agents:
ST. JOSEPH LEAD CO. • 250 Park Avenue • New York 17, N. Y.

BUNKER HILL 99.99+% ZINC

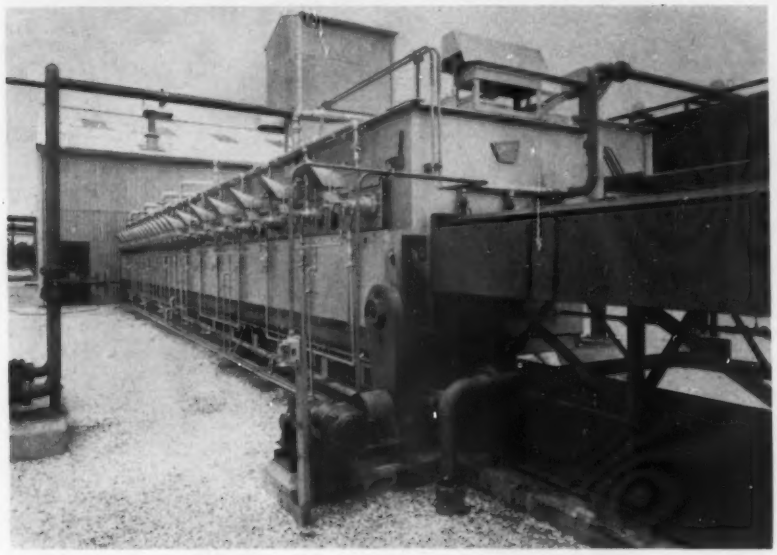
Sales Office For The Pacific Coast
THE BUNKER HILL CO. • 660 Market St. • San Francisco, Calif.

ZH-158

NEWS OF INDUSTRY & ASSOCIATIONS

activities of people, companies & groups in the precision metal molding industries

CONTINUOUS SINTERING FURNACE INSTALLED OUTDOORS



A continuous sintering furnace is a space-using piece of equipment. Drever Company of Bethayres, Pa. in cooperation with the plant management solved this problem at the Freeport Nickel Co., Port Nickel, Louisiana plant by installing the furnace out-of-doors. Except for the loading and discharge ends of the equipment, the entire furnace is outside.

Providing continuous in-line production of sintered nickel briquettes at 8800 lbs. per hour, the furnace is a radiant-tube, natural gas fired, roller hearth type furnace, gas tight for controlled atmosphere operation. By using a continuous mesh belt in combination with the driven rollers, high load capacity is achieved—and trays are eliminated.

The briquettes are automatically charged on the mesh belt and carried through the furnace line which provides zoned heating and cooling areas. At the discharge end of the furnace the sintered briquettes drop onto a scale where they are weighed and packaged. From charge to discharge, the furnace is 156′-0″ long and 10′-4″ wide. The entire operation is under panel board control at the charging station. Water used in the cooling operation is recirculated.

NEW VACUUM MELTING FACILITY

Allegheny Ludlum Steel Corporation will build the world's largest vacuum-melting furnace at its Watervliet Works in New York State, Clark W. King, executive vice president, announced today.

The furnace—of the consumable electrode vacuum melting type pioneered by Allegheny Ludlum and its affiliate, Titanium Metals Corporation of America—will produce ingots up to 50 inches in diameter and at least twice the weight of any vacuum-melted ingots now being produced commercially. The largest vacuum-melted steel ingots available today weigh less than 20,000 pounds; the new Allegheny Ludlum furnace will be able to produce ingots twice this size. With some modifications of auxiliary facilities, ingots more than three times as large as those now available could be produced.

DENISON ENGINEERING ANNOUNCES NEW NORTH CENTRAL REGION

The announcement of the formation of a new North Central Sales Region is made by Denison Neale, director of sales for Denison Engineering Div., American Brake Shoe Company, Columbus, Ohio.

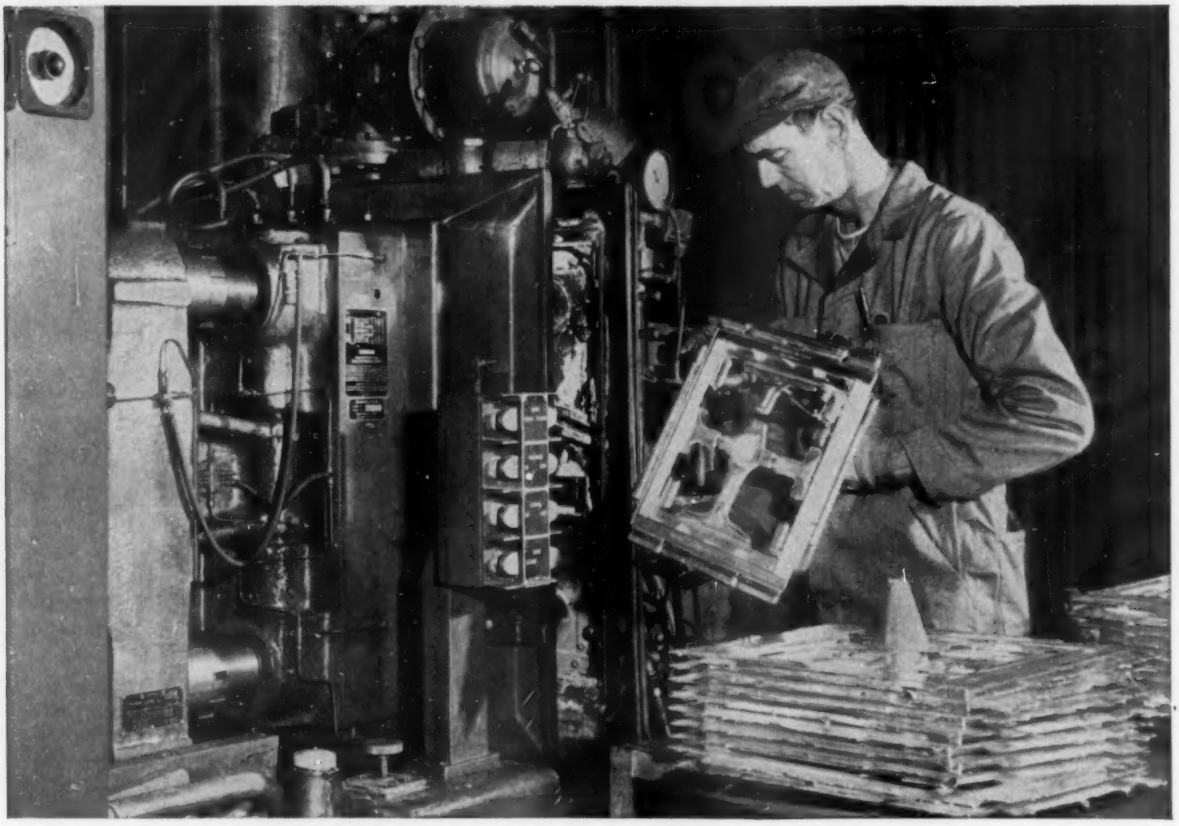
In its new location, the North Central Region will be headed by D. J. Arnold as regional manager. It will handle the sales and distribution of the company's Multipress, hydraulic pumps, motors, and controls from its regional office at 5530 State Road, Cleveland, Ohio.

Operating under the direct supervision of Mr. Arnold are district offices located at Detroit, Mich.; Pittsburgh, Pa.; and Dayton, Ohio.

PRECISION CASTING NAMES BRAMMER V.P.-MARKETING

BRAMMER

Appointment of William N. Brammer to vice president—marketing was announced today by Precision Casting Company, a division of Precasco Corporation. Brammer will head sales, merchandising, and advertising for Precision, which operates plants in Cleveland, Ohio and Fayetteville, N.Y. The company is one of the largest custom producers of aluminum and zinc die castings in the world.



At San Jose Die Casting

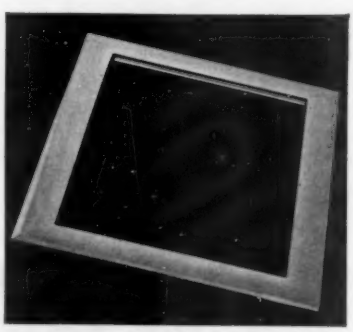
REED VACUCAST CUTS REJECT RATE BY 90%

produces higher quality, lower cost zinc castings

"I'm fully convinced that the REED Vacucast unit is a real business builder, an absolute must in assuring customers the highest quality, lowest cost zinc castings available," says William H. C. Bartlett, President of San Jose Die Casting, San Jose, California.

"Our customer, a large manufacturer of lighting fixtures, experienced a great deal of difficulty in obtaining high quality hardware finish castings. The reject rate was running well over 10%. Since we have been producing these parts on the Vacucast, rejects have been less than 1%. This has meant a considerable cost savings, since the rejects were not apparent until after the polishing and plating operations were completed. Parts now require only one buffing operation with a cotton wheel before plating. Particularly important is the absence of porosity along the trim line, which had formerly caused plating failures."

REED Vacucast gives you many advantages: thinner wall sections, improved finishes, increased cycling time, and a much lower reject rate. And the cost of adapting existing tooling to the unit is very nominal. For complete information about the REED Vacucast system call your nearest REED Sales Engineer today.



One of two lighting fixture units produced on the Reed-Prentice 1½ Zinc Vacucast Machine.

REED-PRENTICE

.....division of

PACKAGE MACHINERY COMPANY

EAST LONGMEADOW, MASSACHUSETTS

BRANCH OFFICES: BUFFALO • CHICAGO • CLEVELAND • DEARBORN • KANSAS CITY • LOS ANGELES • NEW YORK

Circle No. 61 on Reader Service Card

Unmatched purity and uniformity:

FEDERATED ZINC DIE CASTING ALLOYS

Completely controlled production provides you with die cast metals of highest purity and uniformity. Federated Zinc die cast metal is made from ASARCO Special High Grade Zinc, electrolytically refined by Asarco-developed processes. Production is concentrated "under one roof" at Corpus Christi, Texas, one of the world's largest plants producing Special High Grade zinc and die casting alloys. Strategically located warehouse stocks assure you of prompt volume delivery. For complete information about FEDERATED Zinc Die Casting Alloys, write or call: Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N. Y. or your nearby Federated sales office.

ASARCO

AMERICAN SMELTING AND REFINING COMPANY

Low machining costs, superior castability, and an excellent plating surface are the big reasons why zinc die castings are favored for fuel pumps, carburetors, grilles, lamp housing, instrument panels, horn rings, and many other functional and decorative automotive components.

FEDERATED METALS DIVISION

Where to call for information:

ALTON, ILLINOIS
Alton: Howard 5-2511
St. Louis: Jackson 4-4040

BALTIMORE, MARYLAND
Orleans 5-2400

BIRMINGHAM, ALA.
Fairfax 2-1802

BOSTON 16, MASS.
Liberty 2-0797

CHICAGO, ILL. (WHITING)
Chicago: Essex 5-5000
Whiting: Whiting 826

CINCINNATI, OHIO
Cherry 1-1678

CLEVELAND, OHIO
Prospect 1-2175

DALLAS, TEXAS
Adams 5-5034

DETROIT 2, MICHIGAN
Trinity 1-5040

EL PASO, TEXAS
(Asarco Mercantile Co.)
3-1852

HOUSTON 29, TEXAS
Orchard 4-7611

LOS ANGELES 23, CALIF.
Angelus 8-4291

MILWAUKEE 10, WIS.
Hilltop 5-7430

MINNEAPOLIS, MINN.
Tuxedo 1-4109

NEWARK, NEW JERSEY
Newark: Mitchell 3-0500
New York: Digby 4-9460

PHILADELPHIA 3, PENNA.
Locust 7-5129

PITTSBURGH 24, PENNA.
Museum 2-2410

PORTLAND 9, OREGON
Capitol 7-1404

ROCHESTER 4, NEW YORK
Locust 5250

ST. LOUIS, MISSOURI
Jackson 4-4040

SALT LAKE CITY 1, UTAH
Empire 4-3601

SAN FRANCISCO 24, CALIF.
Atwater 2-3340

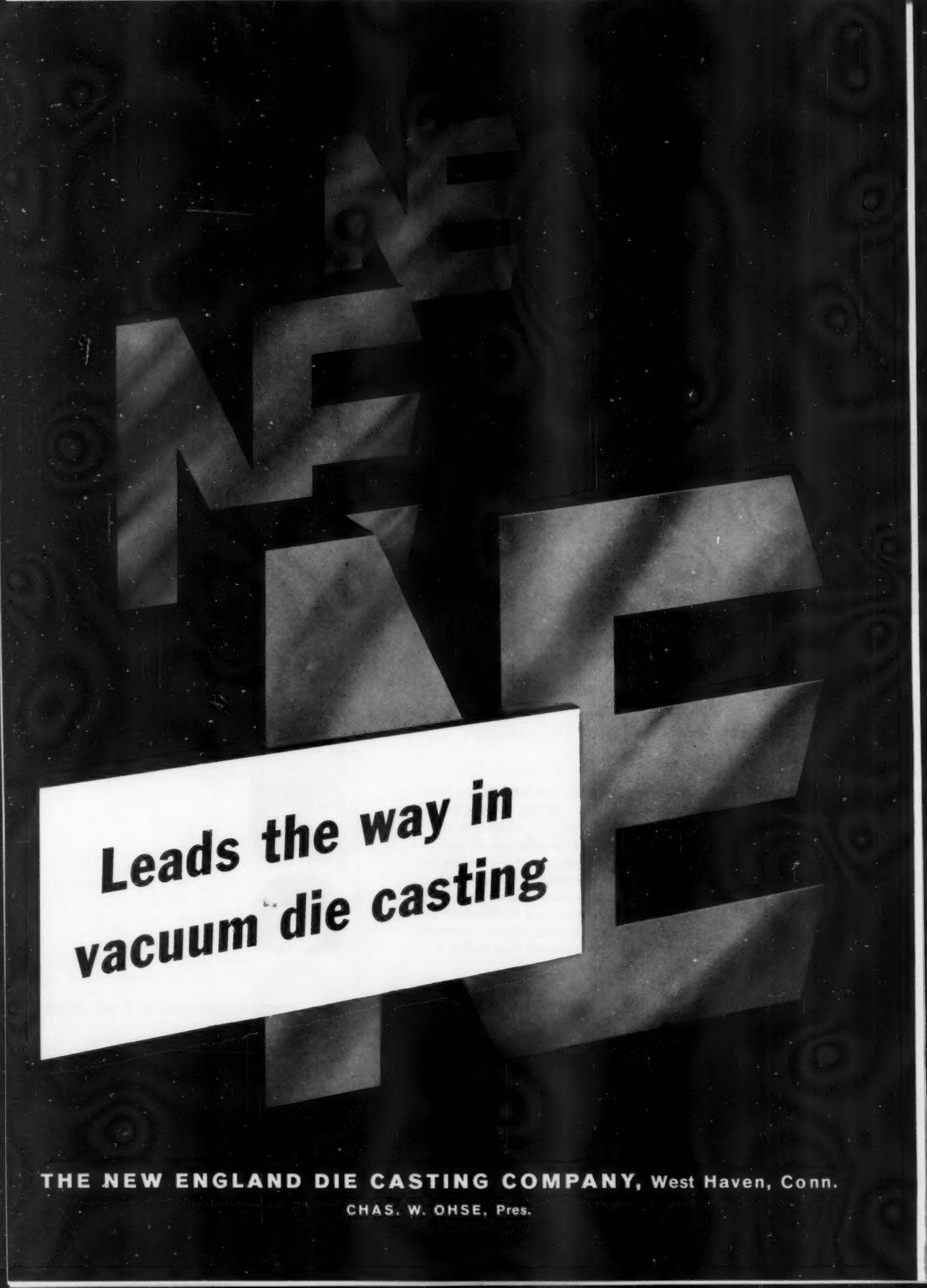
SEATTLE 4, WASHINGTON
Main 3-7160

WHITING, IND. (CHICAGO)
Whiting: Whiting 826
Chicago: Essex 5-5000

IN CANADA: Federated Metals Canada, Ltd. Toronto, Ont., 1110 Birchmount Rd., Scarborough, Phone: Plymouth 73246

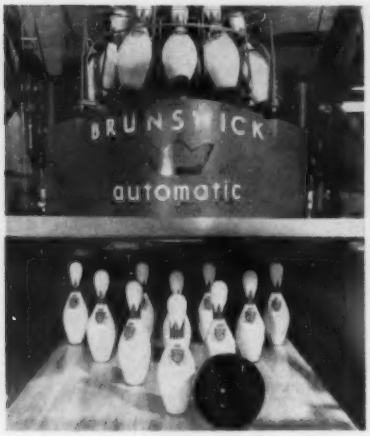
Montreal, P.Q., 1400 Norman St., Lachine, Phone: Melrose 7-3591

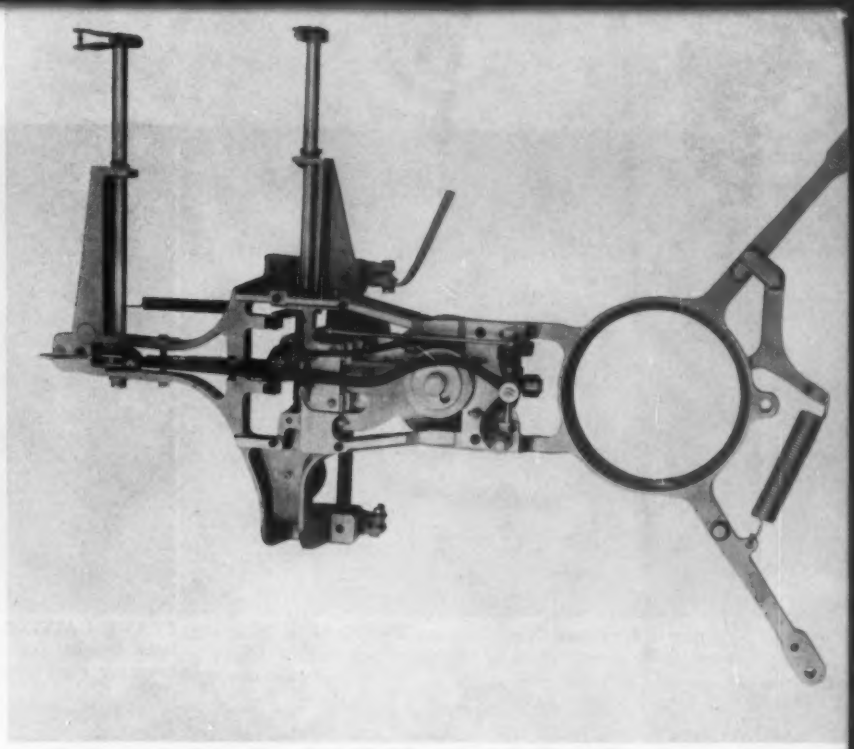
Circle No. 90 on Reader Service Card



THE NEW ENGLAND DIE CASTING COMPANY, West Haven, Conn.

CHAS. W. OHSE, Pres.





THE PIN SETTER (above) uses the permanent mold aluminum casting (right) as the main supporting member for the entire mechanism. By using aluminum the weight was cut, and by using the permanent mold casting process the needed machining was reduced.

Save both weight and money by switching from . . .

CAST IRON TO CAST ALUMINUM

FOR STRENGTH, close tolerances, light weight, and savings in machining, surface finishing, and inspection, use an aluminum permanent mold casting. Those are the reasons engineers at The Brunswick-Balke-Collender Co., switched from a malleable cast iron frame for the indexing turret support on the Brunswick Automatic Pinsetter. The cast iron frame was adequate, but it left much to be desired.

The turret rotates as it accepts the pins that are to be set. When it has 10 pins, it releases them and they slide into a basket, which sets them up in the lane in the correct triangular pattern.

The sand cast iron frame, similar in shape to the one illustrated, had costly disadvantages:

- It needed too much machining.
- It was difficult and expensive to machine.
- The casting would bow after it was malleablized. Straightening was costly.
- It had to be painted to prevent rust.

The sand casting process was inexpensive. The disadvantages, however, ruled out any possible savings.

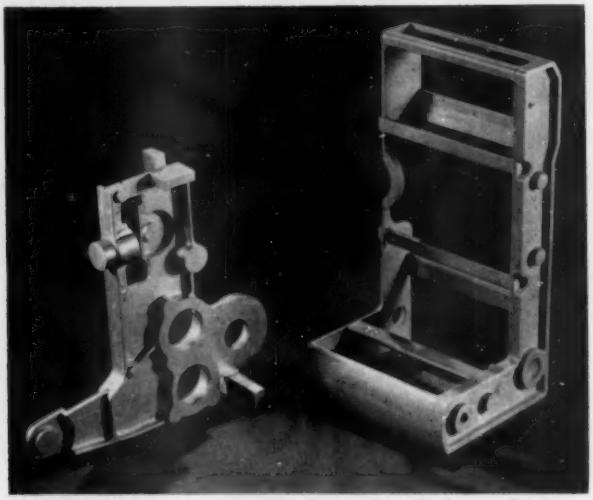
One good way to cast a part of this size and shape, is by permanent mold casting. The process is suitable for either short or long runs. This means savings in stocking and inventory. The metal structure of a permanent mold casting is almost always better than the structure from other casting methods. Coring is versatile; rigid metal cores, sand cores, plaster and shell cores can be used. Finally, with properly designed, well made molds, almost all expensive machining can be eliminated.

The turret frame is cast in 356 alumium heat treated to T6 temper, by the Aluminum Division of The Eastern Malleable Iron Co. Advantages of aluminum are:

- Machining was reduced to a minimum. Both the cast iron and the aluminum frames need the same machining operations. The saving is because aluminum is easier to machine, and there's less metal to remove.
- Weight reduction. The aluminum casting weighs 20 lbs.; the iron casting 40 lbs.
- Tolerances of ± 0.005 in./in. can be held within a mold half with the permanent mold process. These tolerances were sufficient for casting the frame.
- Aluminum is easy to work with. The aluminum frame twists after heat treating. But, it's much easier to straighten an aluminum frame than one of cast iron.

To switch to an aluminum permanent mold casting required one change in design. Aluminum would have been sliding on aluminum at one point in the operation of the pinsetter, a fast way to wear out a part. A stainless steel sheath over the aluminum frame at this point solved the problem.

Unlike cast iron, aluminum doesn't need painting.

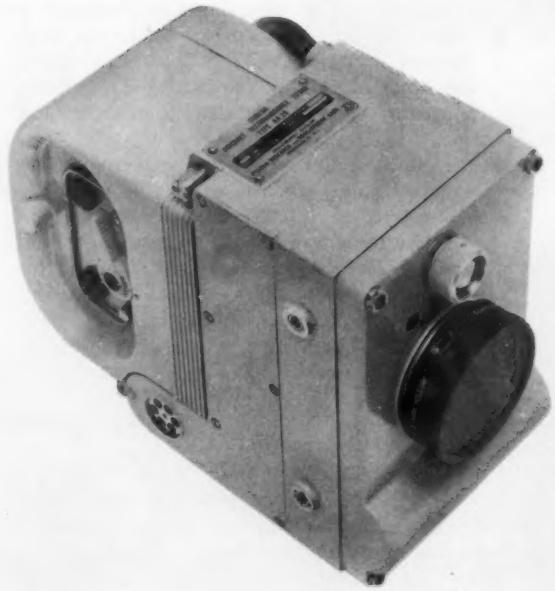


FRAME CASTINGS, intricately designed with thin walls for light weight, but with adequate strength. Only very close tolerance machining needs to be done.

HOW BULOVA SOLVED A HIGH

By N. DUSHEY, *Administrative Engr., Photographic Div., Bulova Watch Co., Inc.*

WHEN PRODUCTION quantities are small, when weight saving is important, when machining costs must be kept low, then aluminum plaster-mold castings may be best. They were for the Photographic Division of the Bulova Watch Company, Inc.



THE PROBLEM was to furnish the Air Force with reconnaissance cameras to use in high speed, low altitude fighter planes.

THE ANSWER is the Bulova 70MM-2 (Air Force Type KA-29) camera. It has a high shutter speed, a high frame rate, and is very light weight.

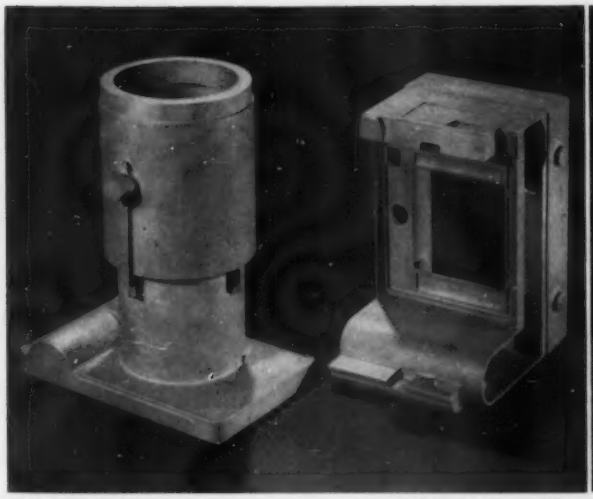
The job couldn't have been done without excessive machining if it hadn't been for plaster-mold castings. Some wall thicknesses are only 0.060" and this meant sand casting would not be suitable. Larger parts ruled out investment castings, and the required quantities eliminated die castings.

The Springfield Cast Products Co., Springfield, Mass., said they could make the castings to our design and specifications. And they aren't easy specifications to meet. General tolerances are ± 0.005 plus 0.001" per in. on dimensions over one inch. Across any parting line they had to hold to ± 0.010, and were allowed a maximum draft of 1°. Fillets and radii were generally 0.10" and the maximum allowable surface roughness was 125 microinches.

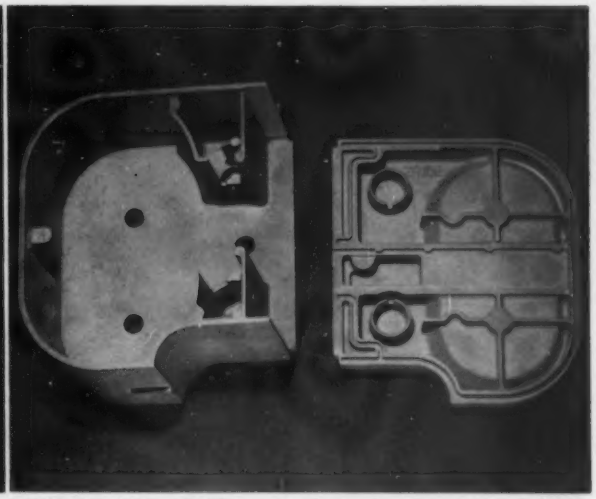
Then on top of all this were some very critical dimensions, which had to be held even tighter. For example, one 6" measurement had a total tolerance of ± 0.005.

Naturally as much machine work as possible had to be avoided, so all noncritical holes more than ⅛" diameter were cored.

The castings made for us had to meet severe environmental conditions, pass a government shock load test, and the entire camera had to operate from 0° to + 120°F.



LENS MOUNT and film carrier castings. Only plaster mold can produce the intricate parts with such close tolerances and good surface finish.



HOUSING AND COVER are easily machined to give a light-tight joint without requiring a lot of excess metal which must be machined off.

TOOLING CHARGE

Of course there's still a lot of machining done on the castings, and where heavy machining must be done they're stress relieved during and after machining.

The illustrations show some of the castings used in this camera. To get an idea of how little machining is required on the plaster-mold castings, consider the housing. As received, it weighs 45 oz. After full machining it weighs 40 oz. That's just a bit over 10% weight reduction.

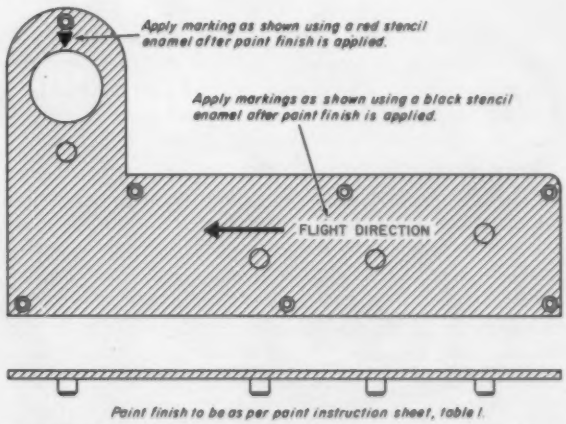
The Air Force specifies the final surface finish of the camera. All exterior surfaces must be baked grey enamel. All parts receive a fine sand-blast and then are black anodized, and those to be enameled have the paint applied over the anodized surface. Each part has a paint drawing similar to the one shown below. Paint is applied to the shaded areas only. In addition to the paint drawing a general specification is furnished which applies to all enamel surfaces. A typical specification sheet is shown in Table I.

Surface finish of all parts must be good enough to withstand a humidity test of approximately two weeks immersion at 95% relative humidity at a temperature of 120°F.

TABLE I
RECOMMENDED SEQUENCE OF PAINT FINISHING OPERATIONS

1. Mask all unshaded areas and holes to ensure that same are free of subsequent paint finish.
2. Apply on all shaded areas a pretreatment coating (phosphoric acid) per Govt. SPEC MIL. -C-15328A.
3. Apply on all shaded areas a gray zinc chromate primer coat, Type II per Govt. SPEC MIL-P-6889A.
4. Apply on all shaded areas a gloss baked enamel, Type II per Govt. SPEC MIL-E-7729A. Color must conform with aircraft gray No. 512 per Air-Force Navy Aero Bulletin No. 166. Film thickness 0.8 to 1.2 mils (dry film).

NOTE: Where applicable, the general specification for protection of aircraft parts — Government SPEC MIL-F-7179 is to apply.


Apply marking as shown using a red stencil enamel after paint finish is applied.
Apply markings as shown using a black stencil enamel after paint finish is applied.
FLIGHT DIRECTION
Paint finish to be as per paint instruction sheet, table I.

A TYPICAL paint drawing which, with the data in Table I, defines the finishing operations, including color.

EXTRUDED ALUMINUM FRAME for a door on a refrigerated case. Lighter weight, stronger, better looking than the older design. Another big advantage, about ½ the cost of the old frame.

AN EXTRUDED CABINET–DOOR FRAME

- Separate Door Handle Eliminated
- Spot-welded Joints Eliminated
- Ready-made Grooves For Rubber Bumpers
- Wheel Brackets Eliminated

By HARRY PRITCHARD,
Sales Mgr., Commercial Extrusions
Superior Industries, Inc.

REDESIGNING A PRODUCT to use extrusions may lower manufacturing costs. But, the manufacturer always wonders: Did I save all I could? One help is for the manufacturer and the custom extruder to cooperate closely. The reason is simple. The extruder knows the design possibilities.

This is illustrated by the door frame we worked on with the Mohawk Cabinet Co. It's a sliding door for a commercial freezer cabinet. The frame supports a 60-lb. sheet of insulating glass.

The frame formerly was made of rolled stainless steel sections. To assemble and finish the door took many parts and too much hand labor. The manufacturing costs were so excessive that it was necessary to consider other methods of manufacture. Redesign of the frame to use extrusions seemed to be an answer. Mohawk's engineers weren't green. They knew that many things could be done with extrusions. Their big question was, how many details could be designed into the extruded frame? We worked with Mohawk engineers to design the entire frame around four 6063-T5 aluminum extrusions. These are: the head section, (figure 1A); the handle section, (figure 1B); the side sections, (figure 1C); the corner key, (figure 1D). The only extras needed to complete the frame are four wheels and 16 screws.

DESIGN ADVANTAGES OF THE ALUMINUM EXTRUSIONS

• SEPARATE DOOR HANDLE ELIMINATED

On the old frame, the handle was a separate piece which cost $2.00 to make. Besides, the assemblers had to bolt it to a wood block that was inserted in the hollow stainless steel frame for support. By designing the handle as an integral part of the frame, the

cost of the handle and assembly is eliminated.

● SPOT-WELDED JOINTS ELIMINATED

The stainless steel frame used to be joined by spot-welding the mitered corners. First the frame was glued around the glass, and then the corners spot-welded. This was a messy job. The glass really supported the frame instead of the frame supporting the glass. After welding, the joint had to be polished to match the rest of the frame. A big drawback to this method of assembly was that the freezer doors had to be made up in advance, and in quantity, to keep assembly costs at a minimum. This raised storage and inventory costs.

The three extrusions, handle, head and sides retain the neat mitered joints. But, the joints are made mechanically, and in a manner that allows the frames to be assembled as needed. This avoided storage and a large inventory.

The joint is made by the use of an extruded corner key (figure 1D). After mitering, six holes are drilled and countersunk in each side section, and two in the head and handle sections. Two of the holes in each side section are to support the wheels.

To assemble the frame, insert the corner key in the groove provided for it in the extrusion (figure 1Aa & 1Ba), then tighten in one screw from each section into the corner key. For extra strength, a screw is tightened into the head and handle sections, from each side, into the extruded hole (figure 1Ab & 1Bb). Assembling the frame in this manner requires a minimum of labor and permits the frames to be assembled as needed. Another advantage is that the glass no longer has to be glued. Instead, a rubber molding strip fits snugly in the groove which holds the glass.

● READY-MADE GROOVES FOR RUBBER BUMPERS

These freezer cabinets have two sliding doors. They need two rubber bumpers on the handle section. On the old door the front bumper was glued on, and could easily be knocked loose. The back bumper required a specially built-up section to mount it. The new design has two gripper grooves in the handle extrusion (figure 1Bc) to accommodate the bumpers. All that's necessary is to force the bumpers into the grooves.

● WHEEL BRACKETS ELIMINATED

The door rides on four wheels, two to a side. The old frame required four special wheel housing brackets, made separately and spot welded to the sides of the frame. The housings were eliminated by designing a groove (figure 1Ca) in the side extrusions. Now the wheels are inserted in the groove and held in place by a screw fastened in from the side.

These four design features provided considerable savings in manufacturing costs. Little machining is required on the extrusions. The side bars are cut to length, 6 holes are drilled and countersunk, and the corners mitered. The head and handle extrusions have two holes each drilled, and the handle section is finished by cutting an angle for the handle on each side and mitering the corners.

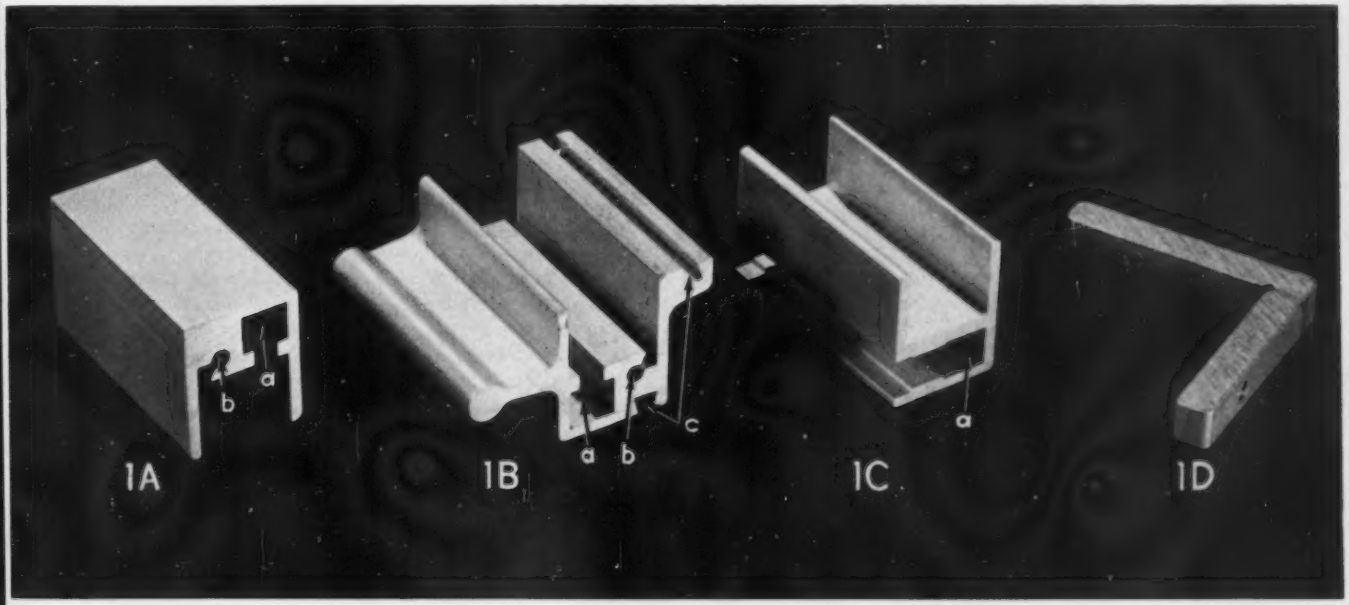
The extruded corner key is cut to length and two holes are drilled and tapped. Finishing on the extrusions consists of:

1 Hand cloth buff.
2 Chemically bright-dipped (Alcoa R5 Process).
3 Clear anodize.

TOTALING THE SAVINGS

The saving in material alone is 25%. Then there was a 25% saving in assembly. Also, there were the savings in inventory and storage. Last, there was another saving in reduced material handling.

FIG. 1 COMPLEX EXTRUSIONS which are easily and inexpensively made permit fast, low-cost assembly of the cabinet doors. With this design, the frame supports the glass. In the older design the glass supported the frame.



Your parts will be an exact fit if you know . . .

HOW TO SPECIFY

MATERIAL	
SPECIFICATION	A.S.T.M. B202-58T TYPE I CLASS A
OIL	YES, ACCORDING TO PRODUCER'S RECOMMENDATION

FIG. 1 WHEN PUBLISHED SPECIFICATIONS completely describe the material, simple specifications such as this can be used.

MATERIAL	
SPECIFICATION	A.S.T.M. B309-58T.
ULTIMATE TENSILE STRENGTH	40,000 P.S.I.
APPARENT HARDNESS	RC 30.
TREATMENT	CARBURIZE .005" TO .010" CASE.
OIL	NOT TO BE OILED.

FIG. 2 WHEN PUBLISHED SPECIFICATIONS do not properly describe the material, then additional information must be added. Always use published specifications as far as possible to avoid any confusion.

WHEN WRITING the specifications for powdered metal parts, there are three basic differences compared with solid metal specifications. These are:

1. The composition of a powdered metal part is not limited by the solubility of one metal in another.
2. A powdered metal part does not have a particular sintering temperature comparable to the definite melting point of a solid.
3. The density of a powdered metal part is variable.

If these three basic differences, and any effect they may have upon production procedure, are considered carefully, then the problems unique to powdered metal specifications will be simplified.

When a part is originally being considered for

POWDERED METAL PARTS

By EUGENE GLEIXNER, *Keystone Carbon Co.*

powdered metal, blueprint specifications should be adequate to insure proper functioning. All unnecessary specifications must be avoided. They will not add to the value of the part but can add much to the cost. An engineer must weigh carefully all factors before he decides what goes on a blueprint. But the vendor must supply, at the lowest possible price, a part which will meet all the specifications or, perhaps, a superior part which can be made at no additional cost. Here are some specification suggestions which will help the buyer get, and the vendor supply, the best powdered metal part at the lowest cost.

MATERIAL SPECIFICATIONS

Material specifications for powdered metal parts are made up of two basic requirements — chemical composition and physical properties. Generally a specification should include both in full detail. Standard powdered metal specifications should be used whenever possible. They are complete and well known. A group of such specifications has been prepared by: American Society For Testing Materials, Metal Powder Institute, Society of Automotive Engineers, and Military Specifications. The A.S.T.M. standards are readily available. Also, a recent publication "A.S.T.M. Standards on Metal Powders and Metal Powder Parts" is the beginning of a complete set of standards.

The standards mentioned above give the chemical and density requirements, expected mechanical properties such as tensile and yield strength, and some others. If one of these standards covers all the neces-

sary properties for a powdered metal application, it should be given on the print (see fig. 1). However, in some cases additional specifications are necessary. The standards may be too general or may not specify all the required properties. In such a case the standard which generally covers the material should be given with the additional requirements. For example, the A.S.T.M. specification for high density iron parts with a 6.9 g/cc to 7.29 g/cc density is B 309-58T Class B. However the various suppliers offer different grades which meet this specification. But, by after treatment such as carburizing and quenching, they can change the ultimate tensile strength and hardness. Therefore in addition to the standard specification, it becomes necessary to specify minimum ultimate tensile strength and hardness (see fig. 2). In other cases, the buyer may not be able to determine what specifications are necessary for a particular application. He should then ask the vendor for recommendations of materials and the necessary specifications. If the part was formerly made of solid steel or as a casting, then some idea of real strength requirements should be given. Frequently a material equivalent to a standard solid material as C1010 steel or A.I.S.I. 8720 steel etc., is specified even though the properties of these materials are not required.

The buyer should describe the material completely when a request for quotation is made. All the possible suppliers will be able to quote intelligently on the part because they will know what material costs and operations will be involved when the part is produced.

TENSILE STRENGTH

When a buyer decides what minimum ultimate tensile strength is necessary, he should specify it on the print. After the buyer has parts which have been proven satisfactory, he should adopt, in agreement with the vendor, a simple breaking or crushing procedure for checking the part. The test method and load should be specified on the print and reference made to special procedures and fixtures which are needed. These tests will prove to the buyer that the strength specifications are being maintained. Also it provides the vendor and buyer with a quick method for detecting any possible changes in composition, density, sintering temperature, etc.

The test generally accepted for oil impregnated cylindrical bearings is the radial crush test. The strength is specified as a minimum K value when K is used in the formula.

$$P = \frac{KLT^2}{D\text{-}T}$$

Where K = Constant depending upon the strength of the material (approx. 2 x ultimate tensile). The value for K has been established by A.S.T.M. for the conventional bearing materials such as the A.S.T.M. B 202-58T materials.
P = radial crushing strength (lbs.)
L = length of bearing (inches)
T = wall thickness of bearing (inches)
D = outside diameter of bearing (inches)

The value of K is important for other reasons than strength. If it is unusually low, the cause may be incorrect composition, low density or incorrect sintering. Any of these conditions could cause bearing failure even though a structural failure does not occur. If the K value is unusually large, the reason may be very high density, which is the same as low porosity, which causes low oil content and failure.

The test generally accepted for odd-shaped structural parts is a crushing test. When a sleeve can be machined from the part, the minimum radial crushing strength can be calculated with the formula given above. For example, when considering the part shown, a sleeve of 1" O.D., ½" I.D. and ½" length can be machined. If the material is A.S.T.M. Type II Class A2, then the sleeve should support a radial crushing load of: P=1,250 lbs.

When considering a part which cannot readily be machined into a sleeve, a crushing load minimum must be determined experimentally. The minimum value could be determined statistically by considering the average value, standard deviation and size of sample tested. However this determined value would not be correct unless the parts were made to minimum specifications. Therefore a specification of 80 to 90% of the average value (depending upon the properties which effect the strength) is usually a good estimate. An example of such a specification is for a part which broke at an average of 2500 lbs. The minimum specification was set at 80% of 2500 or 2000 lbs.

HARDNESS

The hardness of a powdered metal part depends on the porosity. A standard Rockwell or Brinell indenter determines the hardness over an area of voids and particles. The reading is much lower than the true hardness. Rockwell superficial tests use higher loads so the test results are better. For a true test, micro-hardness is used. A correlation between methods exists so any test will do for specification.

SURFACE FINISH

Porosity plays an important part in measuring surface finish. The surface of a porous part consists of a series of flats and pores. When a measuring instrument scans a porous part it cannot distinguish between the actual surface imperfections and the pores. A low density material will always seem to have a very rough surface (see figure 1). For low density material, it is advisable to specify the operations to be performed. The surface of a coined part is much smoother than that of a sintered part. Coining should be specified when a smooth or true surface is required. Grinding or barrel finishing will improve the surface because some of the pores are closed and the particle surfaces improved.

When the density of a powdered metal part approaches the density of a solid part, the error in the surface finish reading is less. Then standard tolerances can be specified. There are three different directions on a surface which should be considered when specifying surface finish. They are parallel to the direction of coining, perpendicular to the direction of coining and the surfaces in contact with the punches. Ordinarily the surface of a part is best in the direction of coining and worst on the surfaces which contact the punches.

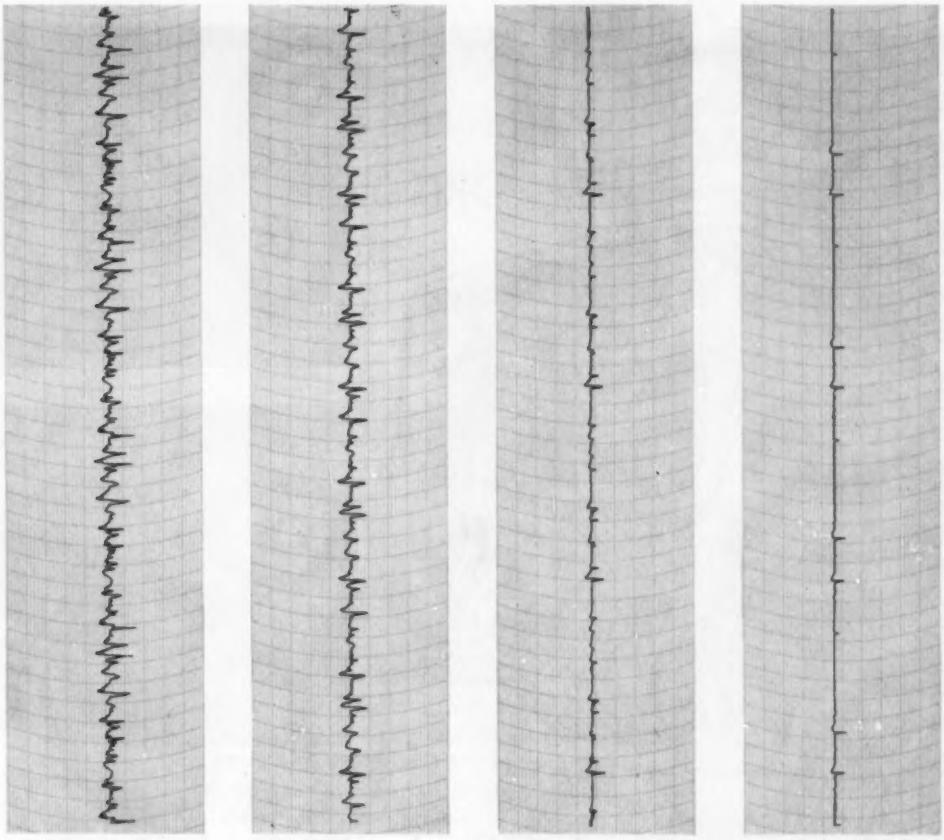


FIG. 1 FOUR TRACES from a surface analyzer. All four parts had the same surface smoothness on the metal particles. They are different only in degree of porosity. This gives an apparent surface roughness that is not true.

LUBRICATION

Not all powdered metal parts are oil impregnated, so the presence or absence of oil should be specified on the print. Parts are often dipped in oil for coining. Any part which must be absolutely free of oil should be specified as such. Specifications which should be avoided whenever possible are exotic or spiral grooves and special oils. They seldom add to the performance of a porous part.

HEAT TREATMENT

Ultimate tensile strength and hardness can be increased by gas carburizing or carbonitriding followed by an oil quench. Due to the porosity of the powdered metal parts, liquid or salt bath carburizing techniques should not be specified. All ferrous parts can be carburized or carbonitrided. When the part is porous, the gas will pentetrate into the pores and carburize all of the surfaces. This improves the hardness and tensile but also makes the part more brittle and causes distortion. Therefore when a low density part is heat treated, wider dimensional tolerances are required. At densities above 7.3 g/cc, the gas does not penetrate into the part and the case becomes defined. Above 7.4 g/cc a very sharp case is formed. The material acts like solid steel.

SPECIAL HANDLING

The powdered metal process is a method of mass production at relatively low cost. Special handling increases costs and should not be specified unless the advantages gained warrant the additional cost. For large parts the additional cost will be slight because the parts are individually handled when they are made. However, small parts which can be automated are bulk handled so the cost of individual handling becomes prohibitive. Special handling and individual packing are required when the parts are heavy, have sharp corners, or when the exterior surface must be nick free.

Examples are gears, bearings which use the outside surface as the bearing surface, and parts which have no chambers but must have sharp corners. When special handling and individual packing are necessary, this should be noted on the print so it is considered when the part is priced.

In addition to the specifications which are given to the vendor, it is always advisable to pass on the history of the part. This history should include a description of the application and any failure problems which have been experienced. An example of how such a history can be beneficial is in the design of a powdered metal gear. If a print of the mating gear is available, it is often possible to design the gear with a stronger tooth and still maintain correct rolling action.

In all cases, close collaboration with the fabricator is desirable because his knowledge of available materials, their properties, etc. is invaluable. Any farsighted fabricator will assist in developing realistic final specifications which will not limit the buyer to himself as the sole supplier, but will assure quality and satisfactory performance of the part.

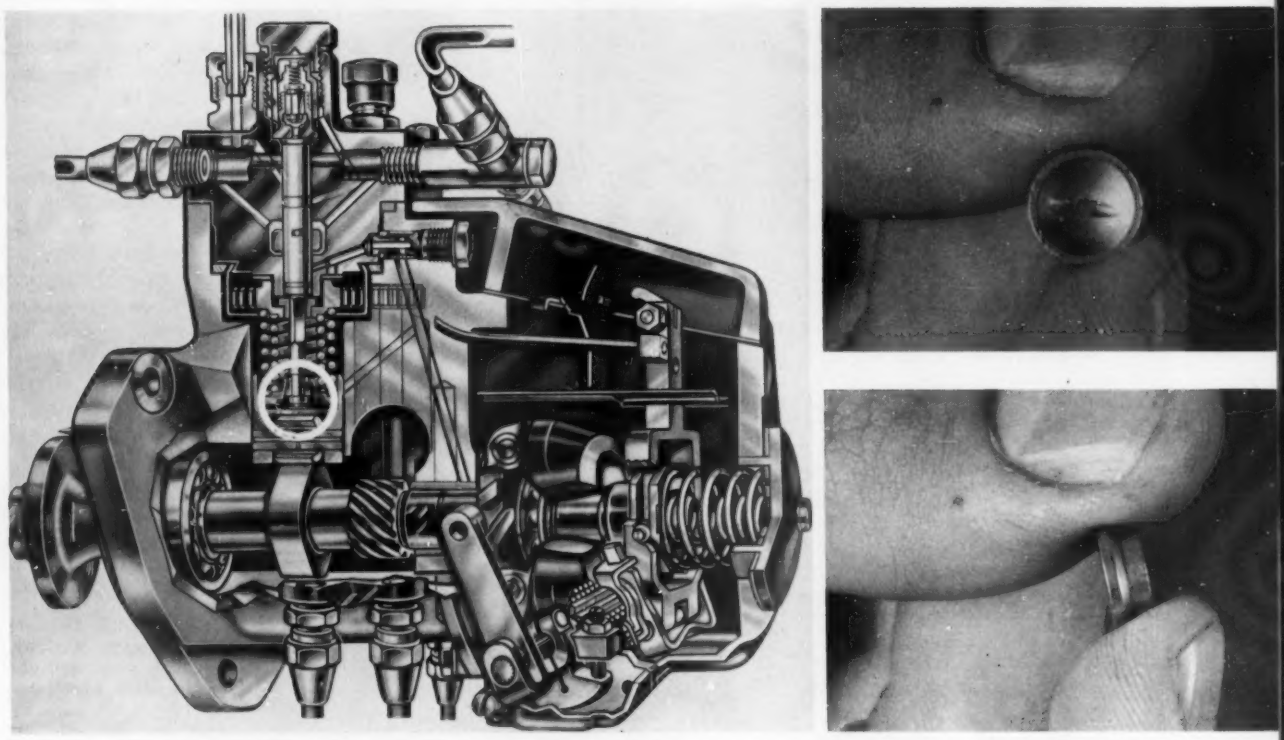


FIG. 1 A TINY SINTERING is used to uniformly distribute a 3000 psi load.

A SINTERING TAKES A BIG LOAD

A TINY SINTERING, scarcely bigger than a dime, helps the American Bosch Arma Corp.'s diesel fuel injector system work.

It's a little powdered iron part called a Plunger Thrust Button that's made for them by the Johnson Bronze Co.

In a single-plunger, fuel-injection pump, diesel oil must be delivered, under pressure, to the spray nozzles in each cylinder. The plunger thrust button furnishes extra bearing surface between the bottom of the plunger and the tappet (see figure 1). In this service the iron sintering works under a compressive load of between 2,000- and 3,000-pounds per square inch. The bearing surfaces must be very smooth and exacting tolerances met on the critical dimensions. These are shown on figure 2.

Surface finish, particularly on the spherical surface, is very important. As the drawing shows, the specification is 30 microinches.

The part is made from an iron, copper, carbon mixture (0.7 –0.8% combined carbon) and is hardened "file hard." To get the dimensional accuracy needed the buttons have to be coined. Then, after hardening, they are barrel finished to secure the necessary smoothness.

These buttons used to be machined from bar stock and, according to American Bosch, were a "production headache."

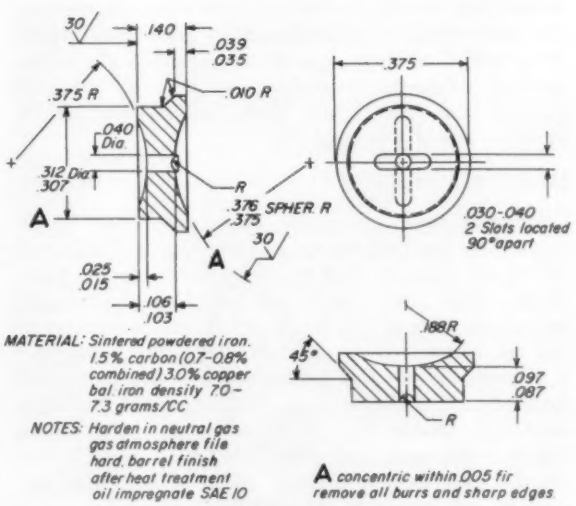


FIG. 2 CLOSE TOLERANCES are met by coining.

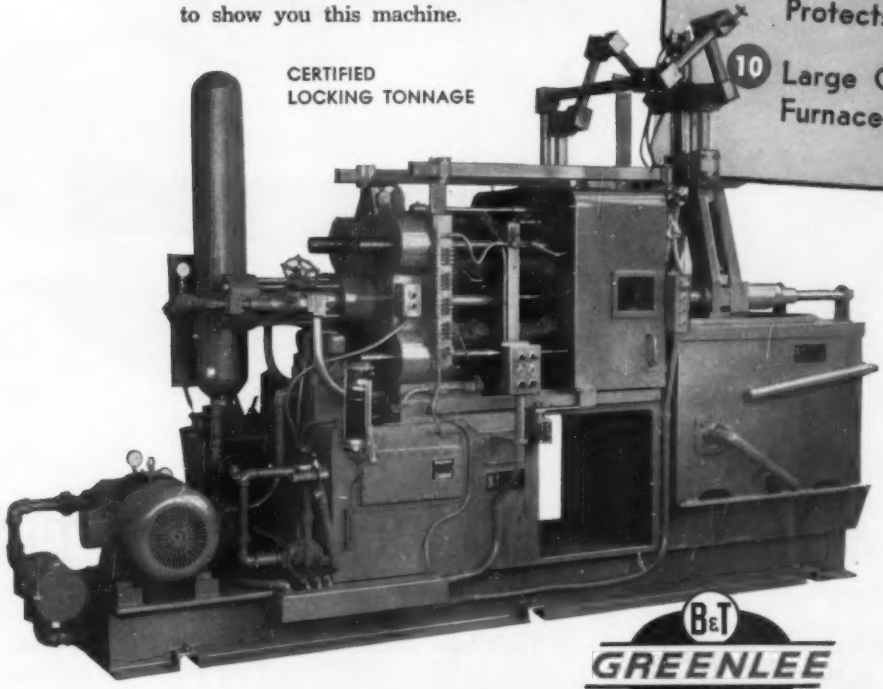
Now with the sintered part the production costs are cut, a nasty machining job has been taken out of the shop, and the slight porosity (the part has a density of 7.0 to 7.3 g/cc) permits oil impregnation to get better lubrication and hence longer life.

10 big reasons why B&T offers you a superior AUTOMATIC ZINC DIE CASTING MACHINE...

The extra strength and precision built into B & T Die Casting Machines gives you thousands of hours of trouble-free operation . . . helps you to increase production and reduce operating costs.

See this B & T Automatic Hot Chamber Die Casting Machine in operation. Look it over. Note the motorized die height adjustment, automatic die lubrication, large conveyor area for automatic part removal, and many other advantages that really pay off on the production floor. Your B & T representative will be glad to make all arrangements to show you this machine.

1. Extra Built-in Beef and Rigidity.
2. A Precision Machine.
3. Four-Toggle Locking Linkage.
4. Massive Tie-Bars.
5. Heavy, Rigid Platens.
6. Automatic Lubrication.
7. Motorized Die Height Adjustment.
8. Automatic Die Lubrication.
9. Low Pressure Closing System Protects Dies.
10. Large Capacity Furnace.



OTHER GREENLEE PRODUCTS

Transfer Machines
Special Machines
Automatic Bar Machines
Woodworking Machines
Tools for Woodworking
Hydraulic Tools For Craftsmen

B&T GREENLEE DIE CASTING MACHINES

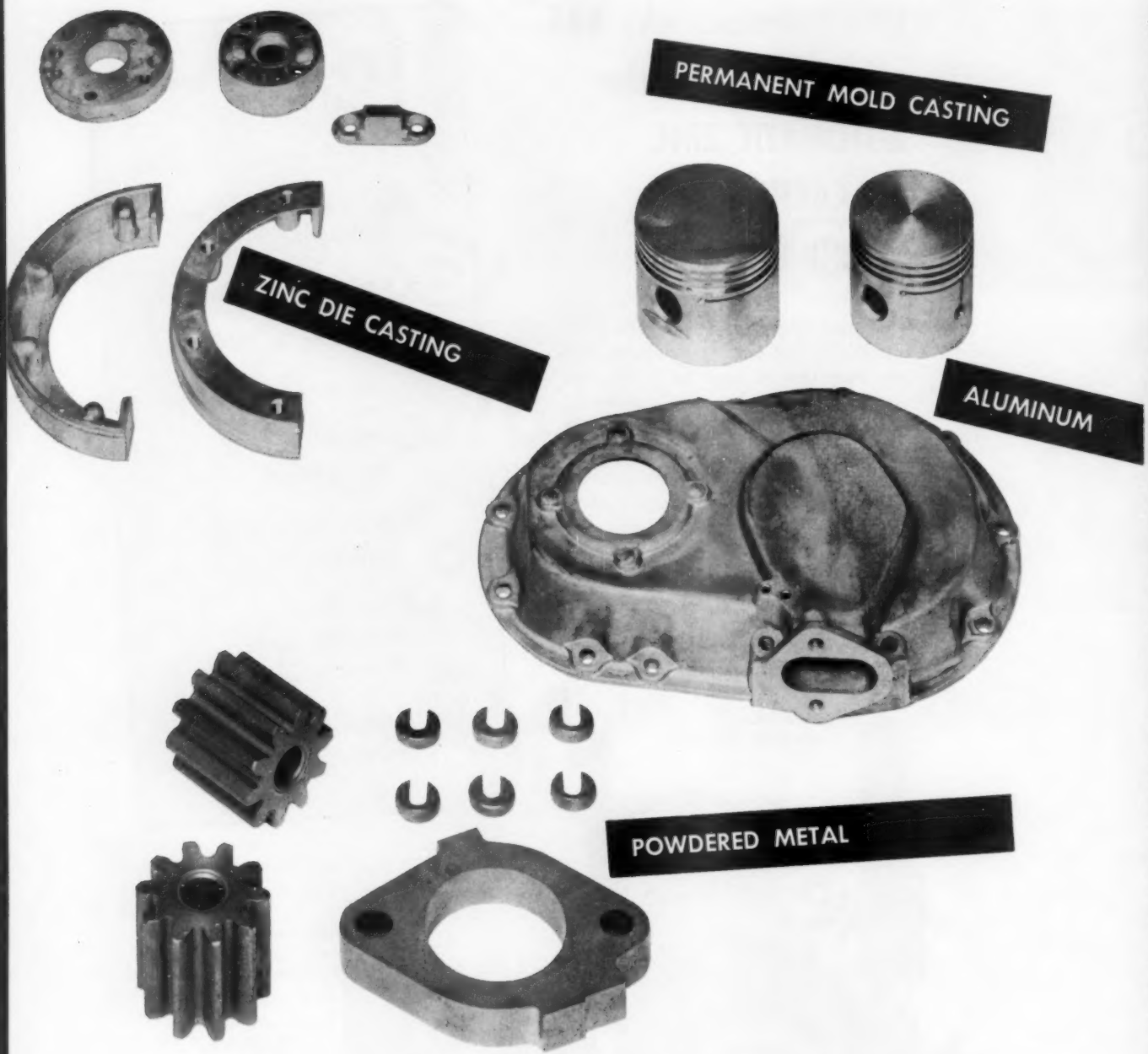
A Complete Line of Hot and Cold Chamber Die Casting Machines
Trim Presses

B & T MACHINERY COMPANY

A DIVISION OF GREENLEE BROS. & CO.

217 W. 8th St., HOLLAND, MICHIGAN, Phone EXport 2-2341

Circle No. 14 on Reader Service Card



THE LARK AND THE

ECONOMY CARS are appearing on the highways in increasing numbers as a cost-conscious public tries to beat the rising cost of living. More and more drivers are taking advantage of the lower initial cost, higher gas mileage, and lower maintenance cost of these smaller cars.

To give the public what it wants (big car features at small car costs), economy car manufacturers have had to trim production costs to the bone.

PRECISION METAL MOLDING processes are helping them.

Let's take the Studebaker-Packard Corp., for example, builders of the *Lark*. They found that by making parts by die casting, permanent mold casting, and powder metallurgy, they are able to reduce greatly, even eliminate entirely, many operations.

There are other advantages too. Not only are initial costs lower, but parts can be designed with a higher strength-to-weight ratio than many machined parts. This weight factor is especially important in the truly economical car. In fact, only by processes such

PMM PROCESSES

as die casting or permanent mold casting can many strong, lightweight parts be made.

Also, many of these parts must serve the dual purpose of being attractive, modernly styled as well as functional. Here again, these often can be made only by PRECISION METAL MOLDING methods.

Shown on these pages are some of the precision-metal-molded parts currently used in the new *Lark*. They include such diverse items as lamp rims, window latches, switch levers, ornaments, handles, molding, emblems, horn rings, gears, gear covers, lock strikers, and pistons.

This list is by no means complete. It is typical only of those parts purchased directly by Studebaker-Packard and assembled in its plant. It does not include the many parts made by PRECISION METAL MOLDING processes which are contained in complete assemblies.

The rising labor market will probably require even wider use of PMM parts if the cost of this compact car is to be held at its present low level.

FIG. 1 CAST VALVE body before and after machining.

Investment castings in stainless steel are one answer to . . .

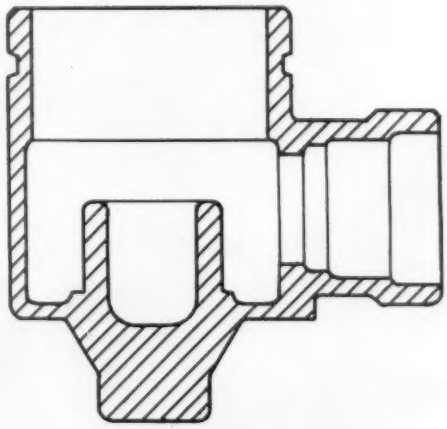


FIG. 2 CROSS SECTION of rough casting.

FAIL SAFE HIGH PRESSURE

IF AN AIRPLANE catches on fire in flight, the fire usually is extinguished in seconds.

The key to aircraft fire extinguisher systems is a valve. It releases the extinguishing agent. In the new Lockheed Electra, this valve body is a stainless steel investment casting (figure 1).

Aircraft fire extinguishing equipment must meet stiff requirements. It has to operate instantly and reliably, but it may not be used for years. The system valve has to be leakproof and must go from closed to open in a fraction of a second.

The valve and valve body have to be fire and corrosion resistant. Engineers at Walter Kidde & Co., Inc. chose a stainless steel investment casting for the valve body.

PRESSURE TIGHT

The valve has a frangible disc located in the neck of the container. It seals in the extinguishing agent. The neck of the container fits into the valve body and is held by a swivel nut. To open the extinguisher, a cartridge in the valve body fires a slug which ruptures

the disc. Nitrogen under high pressure forces monobromotrifluoromethane from the container, through the valve and into the extinguishing system. At room temperature the nitrogen pressure is 600 psi. If released, the valve and body would be subject to this pressure. This pressure increases when the plane is in flight. Altitude, air speed, and heat from the jet engines can build up ambient temperatures to 250°F. This heat increases the pressure in the container to 1500 psi. Sand cast valve bodies could not withstand this pressure. The stainless steel investment cast valve body (figure 4) can withstand 5000 psi.

FIRE RESISTANCE

In conventional aircraft, lightweight aluminum and magnesium sand cast valve bodies are used. They withstand the pressures and are not located in a fire zone. In jet aircraft, the container and valve may be in a fire zone. This requires stainless steel.

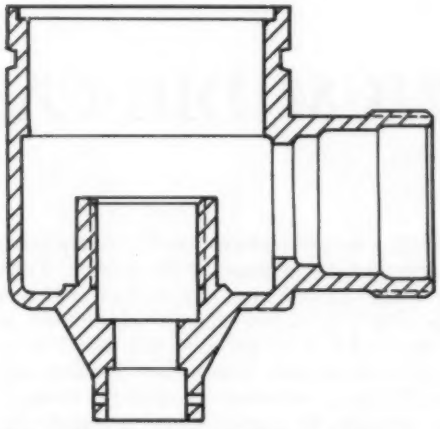


FIG. 3 **PARTIALLY MACHINED** casting.

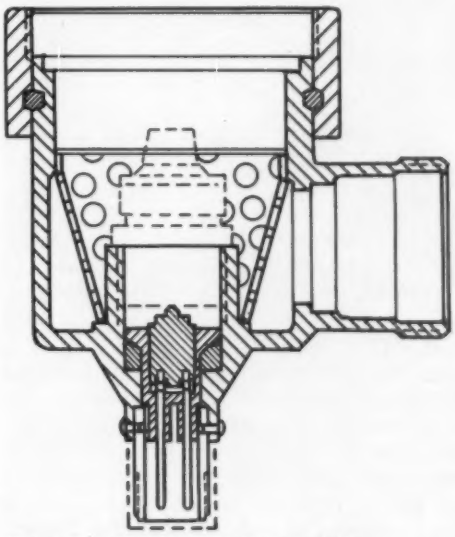


FIG. 4 **FULLY MACHINED** valve body.

VALVE BODIES

CORROSION RESISTANCE

Corrosive conditions are always present. The ends of the system distribution tubes are open. The varying temperatures within the plane, due to altitude and speed, cause condensation in the extinguishing system. This again calls for stainless steel.

Summed up, the investment cast valve body has these advantages:

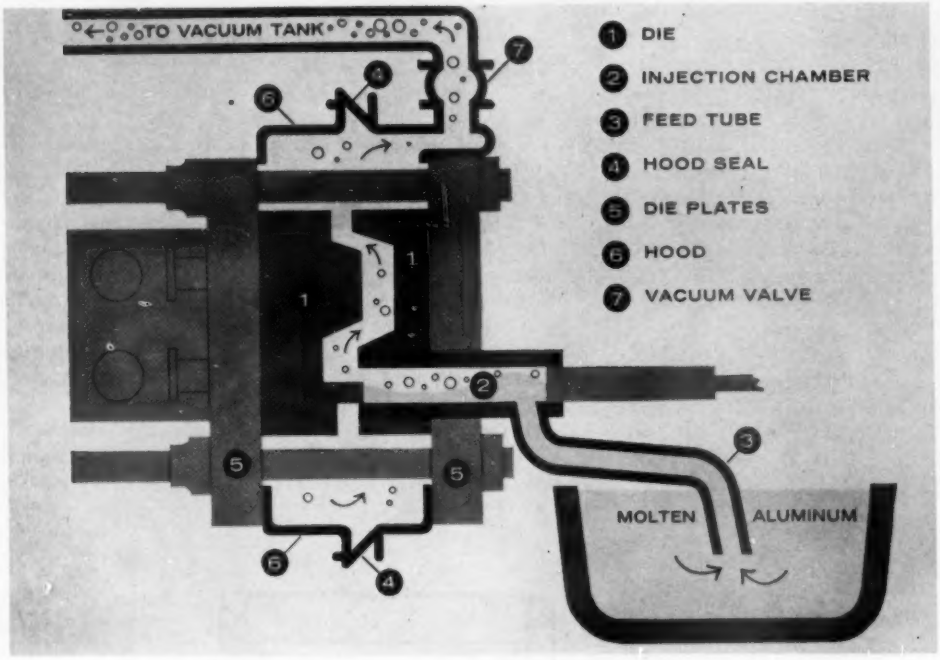
1. The best alloy (type 303) was castable.
2. Reduced weight. Thinner wall sections can be in vestment cast and meet pressure requirements.
3. Easy machining. Type 303 stainless is the easiest of the stainless alloys to machine.
4. Better surface finish.
5. The investment cast valve is smaller than previous valves.
6. Many surfaces are used as-cast. This cuts machining costs.

Thin wall stainless steel tubing is used for the distribution tubes in the extinguishing system. To accommodate these thin wall tubes, a special outlet connection had to be provided in the valve body. With investment casting, the basic outlet shape can be cast. All that's needed is to finish machine. The connection provides a positive seal and permits flexing to reduce the stress on the thin tubing. To do the same with a sand casting would require a lot of machining.

Total machining on the investment cast valve body consists of: 1. Face end and machine a counterbore for the sealing groove. 2. Drill, face and tap the center boss. 3. Counterbore the electrical connector hole. 4. Finish machine the outlet connector. 5. Drill cross holes for ground connection and lock wire.

The valve body is cast by the Jelrus Precision Casting Co. to commercial casting tolerances. The I.D., O.D. and swivel wire groove are controlled to ±0.010.

The sand cast bodies in aluminum and magnesium for conventional aircraft had to be protected from corrosive attack by anodizing and painting. All that's needed in the way of finishing for the investment cast valve body is to passivate after machining.



SCHEMATIC DIAGRAM of the Reed-Prentice Vacuum Die Casting system.

Where to tomorrow with . . .

VACUUM DIE CAST

By EARLE W. REARWIN
Chief Engineer, Die Casting Machines
Reed-Prentice Division Package Machinery Co.

VACUUM DIE CASTING of aluminum offers as much promise for product design in the next five years as vacuum die casting of zinc has meant in the past five — but for entirely different reasons. Vacuum cast zinc parts exhibit improved physical properties such as less brittleness, and allow greater flexibility of design and greater reproduction of detail. There is little, if any, evidence to indicate that the physical properties of aluminum will be improved by this method of processing.

The major improvements will be in producing cleaner, lighter, less expensive castings which will require fewer finishing operations. It will open fields for die cast parts which could not be considered previously, and allow die casting aluminum compositions which cannot be handled satisfactorily by standard die casting techniques.

EQUIPMENT

There is little difference between the zinc and aluminum vacuum die casting machines. The major modification is the method of feeding the molten metal into the injection chamber. More pains must be taken in transferring molten aluminum from the furnace into the injection chamber to prevent oxidation. Hand and automatic ladling are used. At Reed-Prentice, we have developed an automatic vacuum feed system that successfully combines vacuum die casting with automatic ladling.

This system has several features which directly affect properties and cost of the finished die casting. First, the metal is transferred from furnace to injection chamber in a fully enclosed passage maintained at pouring temperature. This protects the metal from oxidation and temperature fluctuation. Second, the molten metal is drawn from the center of the furnace. There is no inclusion of surface dross to impair the properties of the die casting. And, third, each shot of molten aluminum is accurately metered.

VACUUM

There is some difference of opinion over the amount of vacuum which will prove most successful. Both medium vacuum (15 to 20 inches of mercury) and high vacuum (20 to 25 inches of mercury) find their advocates. This controversy is of more than academic interest to designers, as the residual pressure can have a marked influence on the design of both the die and the final part.

Until this indecision is resolved, we are using a 14 x 7 Type ES-1 water-cooled Ingersoll-Rand heavy-duty vacuum pump in combination with a 100 cubic foot tank in conjunction with our 400 and 600-ton presses. This pump has sufficient capacity to achieve 22 to 24" of mercury with a normal die at 2 cycles per minute. The actual pressure in the die will, naturally, vary with die design and cycle variation.

The vacuum pump does more than evacuate the

die. Products of combustion generated from heating the mold lubricant are also pumped out, to prevent staining. Rapid evacuation also provides a wiping action across the face of the die to disperse the die lubricant uniformly. The pressure also affects the velocity of metal flow and gating design.

There are some indications that greatly reduced pressure may be more trouble than it is worth. The obvious results of decreasing the pressure are higher entrance velocity and impingement of aluminum on the cold die chamber walls. Both of these problems can, of course, be overcome by using a larger feed orifice to reduce the velocity of the molten aluminum.

One problem of low die chamber pressure is the possibility of evolution of gases dissolved in the molten aluminum. The known evidence is inconclusive, but caution should be exercised in determining the pressure to use for a particular die casting. It is also important to know — fairly accurately — the pressure in the die cavity.

MATERIALS

Outstanding results have been obtained in vacuum die casting aluminum with varying percentages of silicon. Compositions ranging from trace amounts of

ALUMINUM PARTS

silicon up to 15 to 20% have been successfully vacuum die cast. This is indicative of the wide range of metal fluidity which can be handled by the process.

From 10 to 11% silicon is beneficial for fluidity, but detrimental to anodizing. Only the low silicon aluminum alloys will permit the complete range of attractive coloring. So whatever gain was made in finishing properties was lost in ductility. In the other direction, above the 10-11% alloy, excess silicon produces a much more wear-resistant aluminum. But, again, it could not be die cast with any degree of predictability, as the silicon tended to come out of solution.

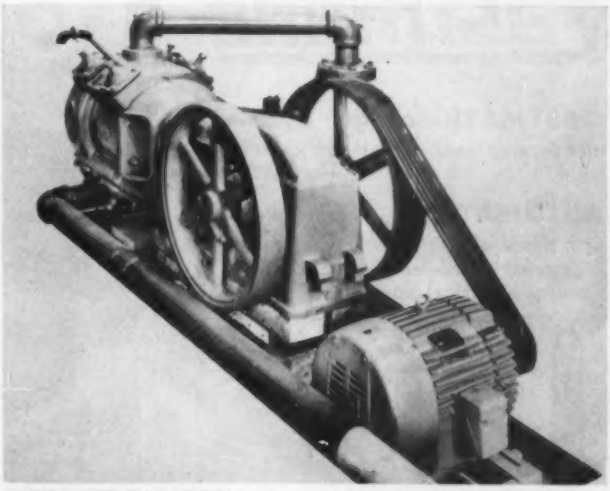
Vacuum die casting solved both these problems. The low silicon alloys have enough fluidity and the excess silicon does not come out of solution when vacuum die casting is used.

COST

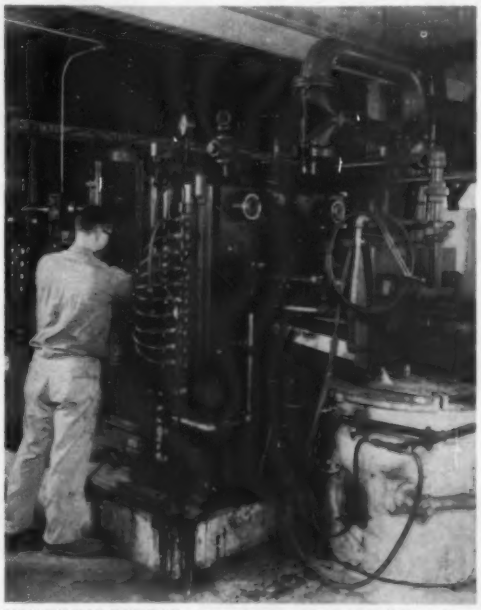
In general, on similar size castings, vacuum die casting should reduce production costs. Smaller, faster equipment can be used to produce a particular part. Locking capacity and injection cylinder capacity are not as much limiting factors as on standard die casting machines. Nor is there the need for as large a reserve of shot capacity or locking strength.

The limiting factor is whether or not the die will physically fit into the machine. By using smaller ma-

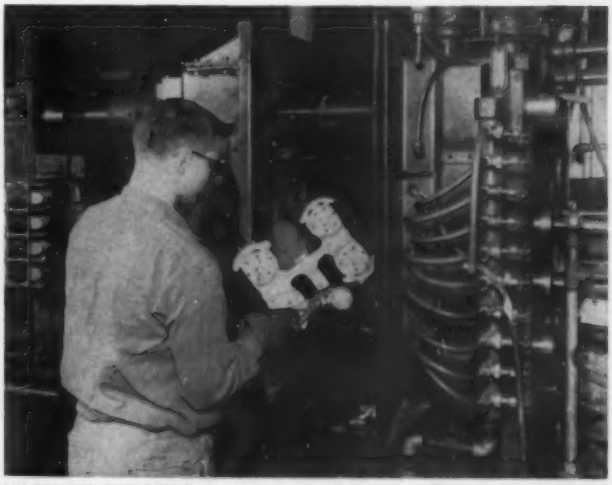
continued on page 60



ADEQUATE CAPACITY in the pumping system is important. This pump will serve a 600-ton machine.



UNIFORM METAL temperature is assured by close coupling between the metal pot and the machine.



VACUUM PERMITS casting some aluminum alloys not castable by conventional methods.

castmatic

TRIULZI

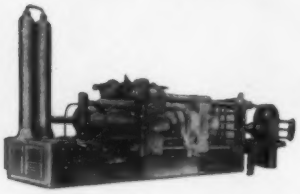
CASTMATIC range
oil operated—self-contained Vickers equipment

AUTOMATIC
with pre-selector panel for arranging up to 8 different schedules
Siemens electrical equipment

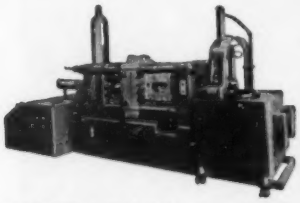
DIE CASTINGS MACHINES

COLD CHAMBER MODELS from 30 to 2200 Tons.
HOT CHAMBER MODELS from 30 to 800 Tons.

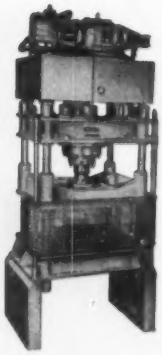
All our machines can be equipped with
★ **devices for obtaining vacuum in the die**
★ **automatic ladling and filling devices**



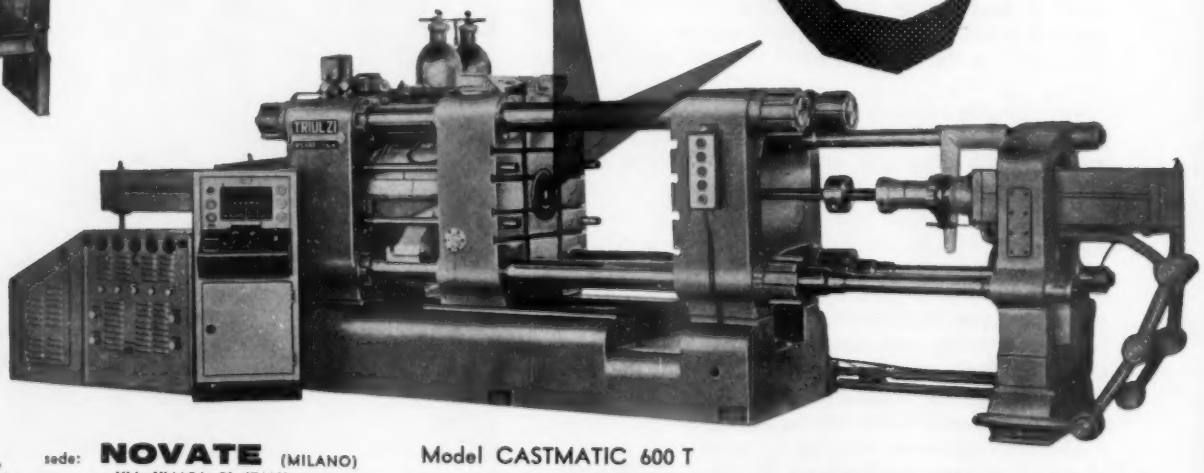
CASTMATIC 2200 T—cold chamber
2200 tons locking pressure. 110 lbs. Al, max. casting weight. 76.7 in. x 72.8 in. platens.



CASTMATIC MODEL Z 250 T—hot chamber
250 tons locking pressure. 13.2 lbs. zinc max. casting weight. 600 dry cycles per hour.



Model TRIM 50
Press for trimming castings. Automatic, self-contained, oil operated. Up to 720 cycles per hour.



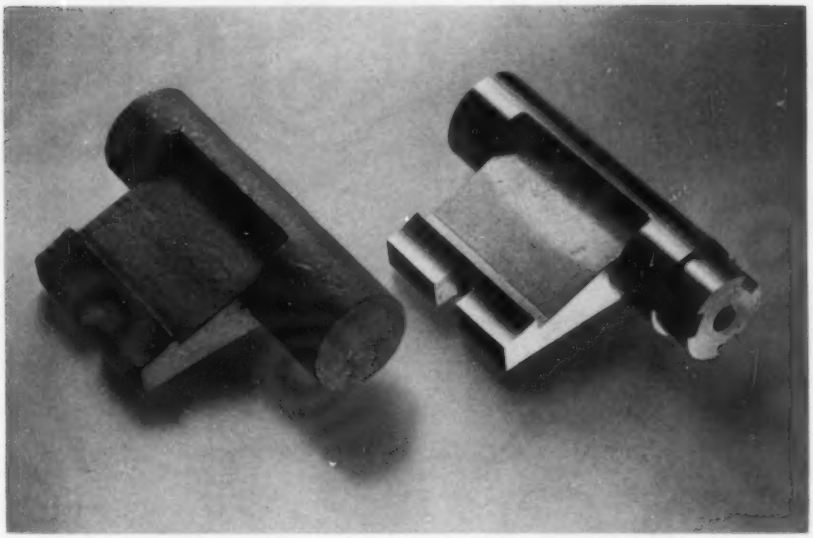
sede: **NOVATE** (MILANO)
VIA VIALBA, 56, ITALY
TEL. 3.491.661/2/3/4 - 3.491.785/6/7/8 [rete di Milano]
Telegr.: TRIULZIPRES-NOVATE MILANESE

We shall attend the Stresa International Die Casting Congress—May 16-20, 1960

Model CASTMATIC 600 T

locking wedge clamping system • motor-driven central screw for adjusting platen daylight • Mobile injection positions • 600 Tons locking pressure 48.5 lbs. copper max. casting weight • 49.2 in. max. clearance between platens • 35.4 in. moving platen stroke • 240 dry cycles per hour.

Circle No. 68 on Reader Service Card



BY INVESTMENT CASTING this pawl is made for 60% less than by machining from stock.

From machining to extrusion to investment casting. That's . . .

THE GENESIS OF A MACHINE PART

SOUND REASONING went into this use of an investment casting in SAE 4615 steel.

The casting shown, a ratchet pawl, is a part of the reversing and drive control on a heavy duty machine tool. It controls accurately the turning of a shaft. It stops the shaft, while it is rotating at 100 rpm, in either direction. This sudden stop puts a shock load on the pawl severe enough to peen and distort any material softer than 60 Rockwell C. In addition there are both tensile and compressive stresses set up. Three keys are used to mechanically throw and hold the pawl in the path of the shaft. If fewer keys were used, the key slots would sheer. Also, there is severe wear. The part is housed in a closely fit hydraulic housing where there's high wear, sufficient to eventually require replacement, even though there is continuous lubrication.

Originally the pawl was machined from wrought stock. The performance was excellent, but the cost was excessive. To reduce costs, it was redesigned as a steel extrusion. Short lengths were cut from the extruded bar and then machined to specifications. This showed a savings of approximately 40%. The extruded pawl was used until shortages of alloy steel cut off the supply.

The steel extrusions had one big disadvantage. The only way to get the maximum savings was to buy at least 3 tons of extrusions. Since only 100 pawls a year were needed, 3 tons would be a 5- to 10-year supply. This raised a problem of storage. Then there were design changes. This created the even greater problem of obsolescence and loss. (This objection is no longer valid. Today very short runs of ferrous extrusions are common.—Ed.)

So, rather than go back to machining from bar stock, other methods of fabrication were considered. A relatively new process in the 1940's, investment casting, was decided upon. Still in its early stages of development then, it had many advantages.

Casting the pawl eliminated two machining operations, and the rest of the machining time was cut considerably. A wide variety of steel alloys could be cast. Many alloys that still cannot be handled by other fabricating methods, can be investment cast. Also, the casting accuracy and surface perfection were very good. The tooling costs were moderate.

Another big advantage was that the company could get small orders. Delivery was fast, just a few days on reorders. Totaled up, the advantages of the investment casting process showed a 60% savings compared to machining from wrought stock.

Functionally, the extruded pawl and the cast pawl are about the same. Certain changes were necessary, however, so that it could be cast. It had to be lightened to meet requirements of the investment casting process at the time. This was done by designing in reliefs, thinning the sections, and shortening the paddle at both ends. Overall casting tolerances of ± 0.005 are held. Although investment castings can be held some what closer, the specifications are so tight that certain parts of the pawl would have to be machined anyway.

Only 8 operations are needed to complete the pawl:

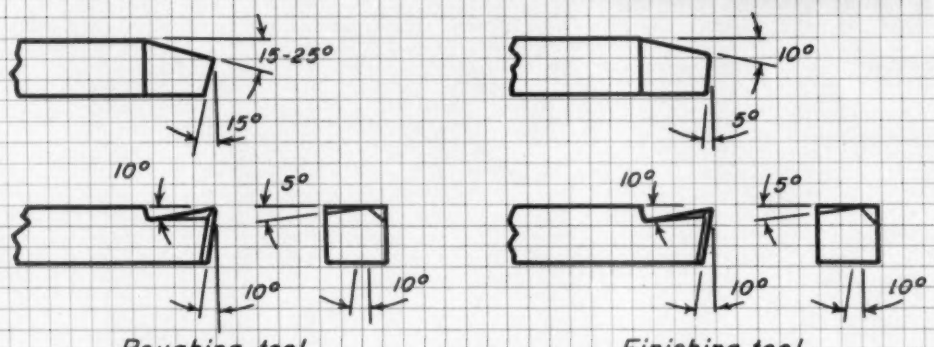
1. Drill and tap the plain end.
2. Center the plain end.
3. Turn the keyed end.
4. Center the keyed end.
5. Mill the 3 keyways.
6. Case harden to 60+ Rockwell C.
7. Grind the whole radius.
8. Grind the radius that contacts the shaft.

use these PMM

Design Tips

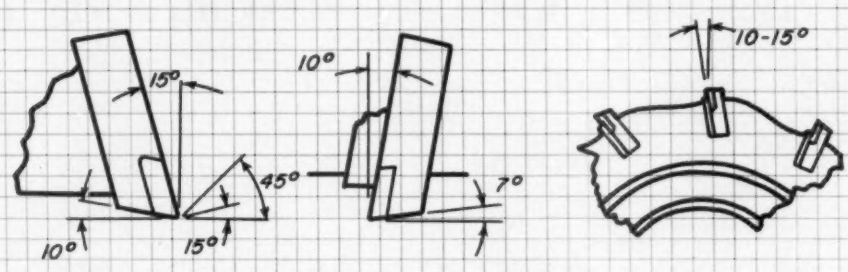
for lower costs
-better products

Here are suggested tool designs for machining magnesium

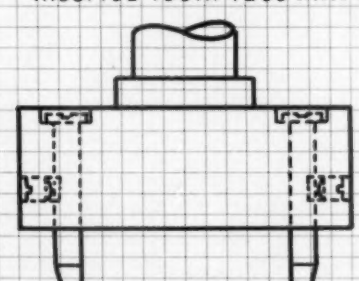


Roughing tool — Finishing tool

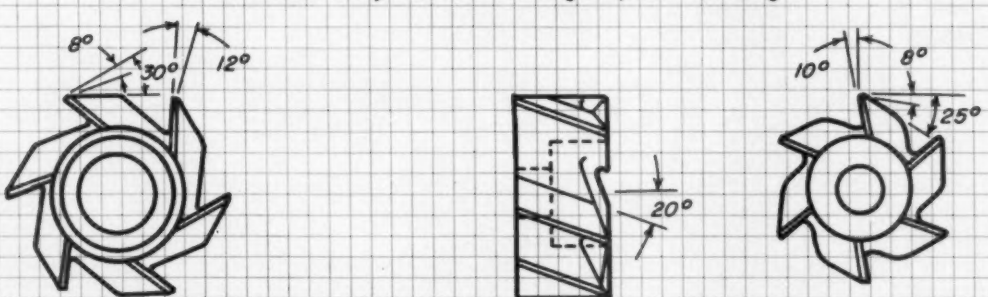
Turning tools for magnesium



Inserted tooth face mill design



Two blade fly cutter for high speed milling



Coarse tooth milling cutter — Shell end mill

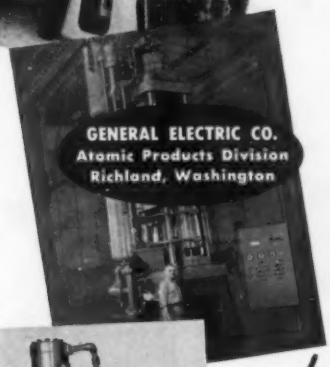
Milling cutter for use on magnesium

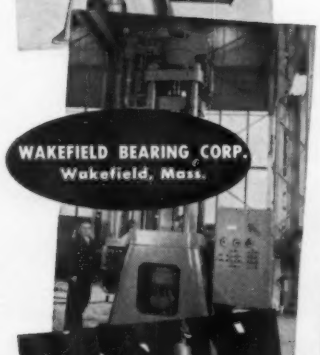
COURTESY OF THE DOW CHEMICAL COMPANY

THESE BLUE CHIP COMPANIES HAVE RECENTLY INSTALLED THE ALL-NEW

Kux

POWDER COMPACTING PRESSES because:





✓**PUSH BUTTON CONTROL** permits simplicity and flexibility in adjusting fill, pressure, ejection, timing to suit the part being made.

✓**BUILT IN BALL BEARING LEADER PIN GUIDE BARS** between both the upper punch holder and the die table, and the lower punch holder and die table provide and maintain perfect tooling accuracy.

✓**SECONDARY LOWER PUNCH MECHANISM** for use in pressing and/or ejecting.

✓**POSITIVE MECHANICAL PRESSURE STOP MECHANISM** for holding dimensional thickness, or hydraulic pressure control for true density can be utilized.

✓**TWO INDEPENDENT FEED SHOES** for producing compacts from two different materials.

✓**22 DESIGN INNOVATIONS** that make possible the production of the most complex parts.

✓**FULL RANGE OF SIZES** from 50 to 500 tons.

Also a complete line of high speed mechanical compacting presses for powdered metal parts, ceramics, carbon products, iron cores, tungsten, carbides, plastics and other materials.

Write for complete catalog

KUX MACHINE CO. • 6725 NORTH RIDGE • CHICAGO 26, ILLINOIS

Also builders of a full range of die casting machines . . . from 25 tons to 1000 tons in size.

Circle No. 46 on Reader Service Card

Use **BRASS**

Die Castings for intricate cored parts with thin sections

Here's why! You need little or no secondary machining on Titan brass pressure die castings. Look for intricate shapes and deep cored holes in your component parts and you'll spot a Titan die casting, *or the need for one.* Tough assignments such as thin metal sections and complicated shapes are standard custom when designed as a Titan brass pressure die casting.

To save weight, wall sections as thin as .070 inches are possible. Even 1/32-inch section is accomplished by Titan craftsmen if the section area is right.

Compare with sand castings and other metal forms you now use. You'll discover the sharper outlines, dimensional accuracy, higher strength and fine grain structure of Titan brass pressure die castings.

Titan design specialists will work with you to make your product better with the proper brass die-cast part.

May we say more? Call your nearest Titan Office for detailed information and a brass die casting quote.

45 Years of Quality Brass

Titan®

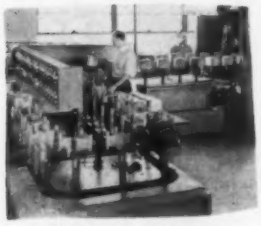
METAL MANUFACTURING COMPANY
DIVISION OF CERRO DE PASCO CORPORATION
Bellefonte, Pa. • Newark, Calif.
Offices & Agencies in Principal Cities
RODS • FORGINGS • DIE CASTINGS • WELDING RODS • WIRE

Send for latest folder on Titan pressure die castings. Write us on your letterhead.

Circle No. 69 on Reader Service Card

AUTOMATIC BUFFING

TRIMMING



AUTOMATIC PAINTING

The specialized finishing metals, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here.

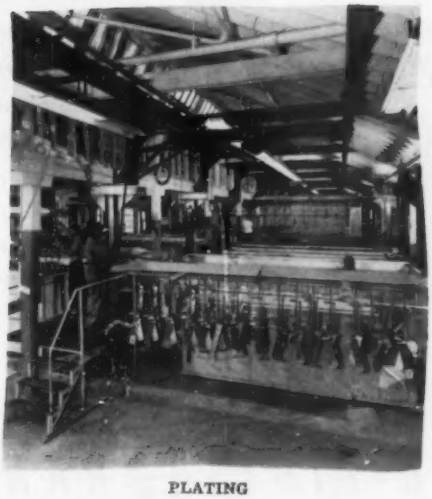
PMM

FINISHING SECTION

PORCELAIN ENAMELING ON ALUMINUM *PAGE 55*

BARREL FINISHING

SPRAY PAINTING



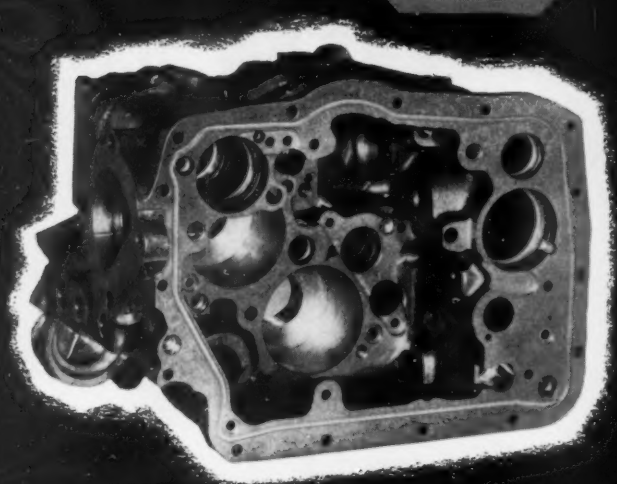
PLATING

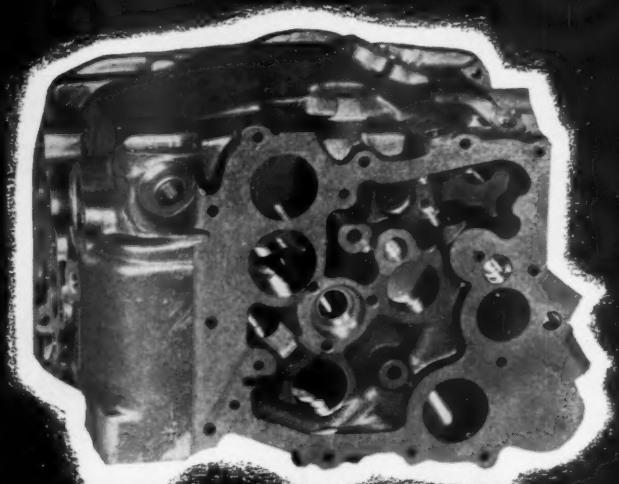
HAND BUFFING

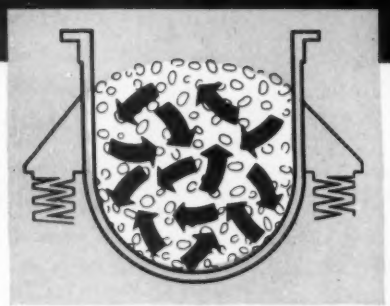
This includes all secondary operations which convert a raw casting to a finished casting.

MACHINING

CALL ON **ROTO-FINISH RANSOHOFF** FOR *Finishing Results* LIKE THIS . . .







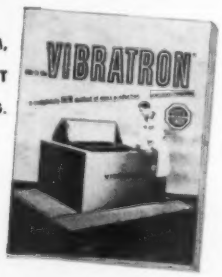
CONSTANT OVERALL ABRASIVE ACTION—The Vibratron work zone extends throughout the abrasive mass. Every surface is subject to constant vibrating abrasive action.

NO MORE MANUAL HANDLING of parts and media. A built-in removable separator does the job. There's no need for an extra separator.

COMPLEX ALUMINUM CASTINGS DEBURRED 2 at a time . . . in 15 minutes . . . . . the **VIBRATRON** way!

Woodward Governor Co., Rockford, Ill., long a leading manufacturer of all types of governors for prime movers, manufacture such highly precise equipment as jet engine fuel control systems. Precise finish and dimensional tolerances are a must! The fuel control shown above was previously hand deburred and then tumbled in a multiple compartment machine for 1 hour. Now . . . these cases are processed *2 at a time in 15 minutes* in the Vibratron. No hand operation is required and the finish is more uniform.

IF YOU NEED HELP ON A FINISHING PROBLEM, *Write or Phone today* **FOR FULL PARTICULARS. IT WILL PAY YOU TO GET THE FACTS ON VIBRATRON PROCESSING.**



ROTO FINISH

ROTO-FINISH / RANSOHOFF

3716 Milham Road, Kalamazoo, Michigan — Phone: Fireside 3-5578

FOREIGN REPRESENTATIVES: ARGENTINA—Taller—Buenos Aires ● AUSTRALIA—A. Flavell Ltd.—Cheltenham ● BRAZIL—Commercial E. Industrial de Fornos Werco, Ltd.—Rio de Janeiro ● CANADA—Canadian Hanson & Van Winkle Co., Ltd.—Toronto ● ENGLAND—Roto-Finish Ltd.—Hemel Hempstead ● FRANCE—Societe Roto-Finish—Paris ● GERMANY, AUSTRIA, NORWAY, SWEDEN, SWITZERLAND—Metallgesellschaft A. G.—Frankfurt, a. M.—Germany ● HOLLAND, BELGIUM, LUXEMBURG—N. V. Roto Finish Maatschappij—Delft, Holland ● ITALY—Societa Roto-Finish a R. L.—Milan ● MEXICO—Enthone de Mexico, S.A. Prol Pina 669, Mexico 15, D. F. ● SPAIN—Instituto Electroquimico, S. A.—Barcelona

Circle No. 76 on Reader Service Card

Improved product design
with . . .

PORCELAIN ENAMELING ON ALUMINUM

WHERE A COLORFUL, glossy, hard or durable surface is required, the designer should consider aluminum with porcelain enamel.

Porcelain enamel is easy to apply using conventional enameling and firing procedures. The resulting finish looks like a ceramic surface. It can be used to decorate cast surfaces too rough for color anodizing.

The enamel formula is designed to meet the specific needs of an intended use. It can be designed to resist all acids except hydrofluoric. Other types are not affected by akalies. As a group enamels are not affected by salt water, organic chemicals or solvents.

They can be heated and will not stain, streak or lose color when repeatedly exposed to strong detergents. That's why they're used to decorate cooking utensils.

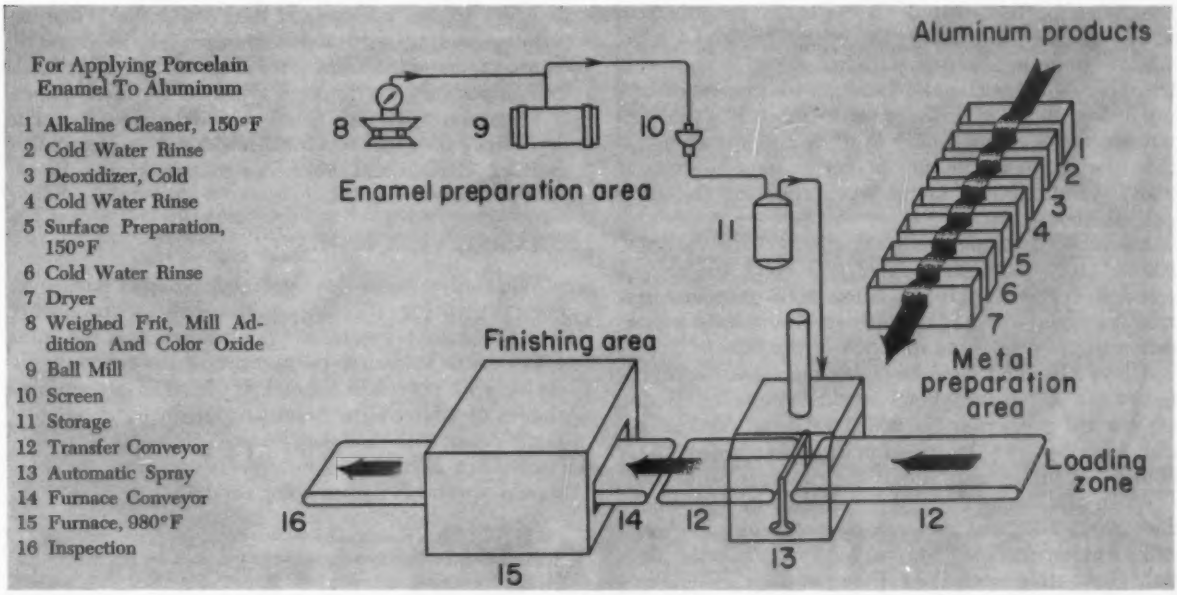
They resist abrasion and hold up well in industrial atmospheres. They are specified for airport markers where there's a lot of dust laden wind blasts. Tabor abrasion resistance values are 0.0078 g. for the best types (1600 cycles, 1000 gram load and CS17F wheel).

Porcelain enamel hardness ranges from 3½ to 6 on Moh's scale (Knoop hardness varies from 149 to 560, while the Sward rocker hardness is 100, the same value as plate glass). They have good resistance to gouging and crushing.

Porcelain enamels will not spall and can be drilled, sawed or formed without starting a progressive deterioration. There's no need to worry that the appearance of a formed or machined enameled part will deteriorate with time. This helps when there must be minor adjustments at installation.

They are thermally stable and withstand temperatures to within 300 degrees of the firing temperature without damage. Thermal shock resistance varies with thickness and composition, but is usually good. Some enamels can be heated to 1000 degrees and plunged into cold water without cracking or flaking.

They are non conductors of electricity. Some have dielectric values of 500 volts per mil thickness.



MECHANICAL PROPERTIES OF PORCELAIN ENAMELED 6063 ALUMINUM ALLOY [1]

Alloy	Thickness Inch	Cooling Method	Aging Treatment	Approx. Temper	Ult. Tensile Strength Kips [2]	Yield Strength Kips [2]	% El
6063 [3]	.120	Still Air	None	T-4	25.1	11.9	21.5
6063	.120	Still Air	Yes [4]	T-6	34.7	29.5	13.0
6063	.120	Air Blast	None	T-4	24.9	12.0	21.5
6063	.120	Air Blast	Yes [4]	T-6	34.4	30.0	13.0
6063	.120	Water Quench	None	T-4	25.7	12.1	21.5
6063	.120	Water Quench	Yes [4]	T-6	37.5	33.1	14.0
6063		Guaranteed Properties		T-4	17.0	10.0	12.0
6063		Guaranteed Properties		T-6	30.0	25.0	8.0

Notes:

(1) All metal fired for 5 minutes after furnace temperature recovered to set point of 990 F with Alcoa R-100 used as a surface preparation.

(2) Kips—1000 #/sq. in.

(3) Extruded shapes.

(4) Aged 8 hours at 350° F.

MAKING THE ENAMEL

Porcelain enamels are made from color pigments, opacifiers, mill suspension agents, and glass frits. These are supplied separately and blended by grinding in conventional ball milling equipment. They fuse to the metal surface when fired at temperatures around 900°F. The finished coating looks like an extremely thin layer of colored opaque glass. The surface texture, degree of gloss and color are controlled by the chemical composition.

Enamels are usually applied in two or more layers. The top one resists abrasion best. Abrasion resistance increases when titanium dioxide is used as an opacifier.

ALLOY CONSIDERATIONS

The firing temperature of porcelain enamels is above the annealing temperature of the common aluminum alloys. A heat treatable type alloy should be used where strength is required. After firing a non-heat-treatable alloy will have mechanical properties approaching those of fully annealed metal in the –0 temper. Some enamels have firing temperatures higher than the incipient melting points of some aluminum alloys. Consider that factor when choosing the alloy and enamel.

Alloys 43 and 356 are recommended for castings. Alloys 1100, 3003, 6061, 6062 and 6063 are recommended for extrusions. Alloy 6063 is sometimes troublesome because it requires careful surface preparation to get maximum adhesion of the enamel.

Alloys 1100 and 3003 have the mechanical properties of the –0 temper when porcelain enameled. Better mechanical properties for 6061, 6062 and 6063 alloys can be obtained by precipitation hardening. The number of firings also affects the physical properties.

When the enamel coating is 3 mils or less thick, alloys 6061, 6062 and 6063 can be water quenched and still maintain the specified mechanical properties that they show after solution heat treatment.

Specified mechanical properties can also be obtained by air blast cooling if enough air is available to get rapid cooling. When a thickness over 3 mils is required, water quenching is not recommended because the enamel film would have a tendency to microspall.

DESIGN CONSIDERATIONS

The enameler will have trouble with thin walled extrusions and shapes requiring large overhanging tongues, especially if the wall or tongue is much thinner than the main mass of metal. These shapes will often warp and twist during firing and are usually difficult to straighten. Enameling both sides of the shape will lessen the warpage, but even this will present straightening difficulties.

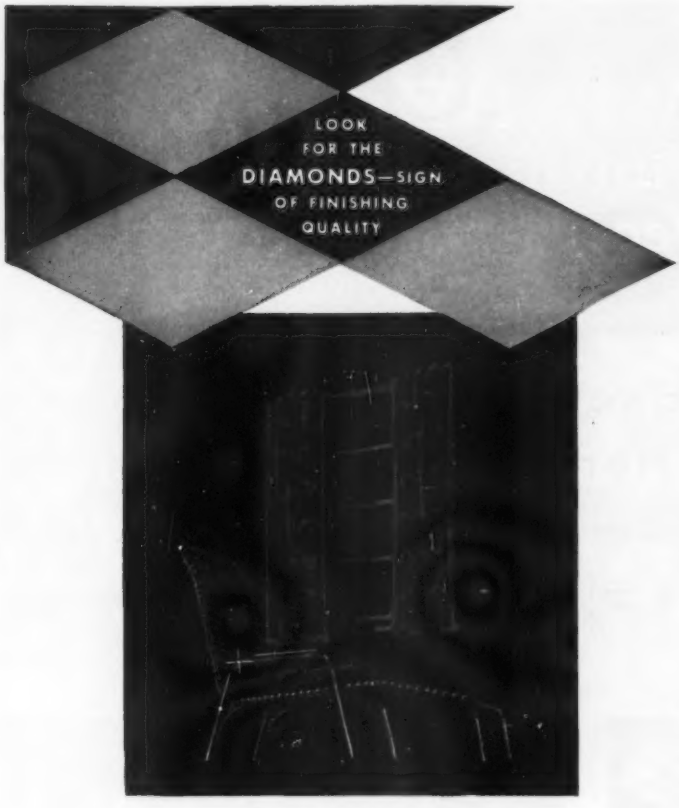
Allow for the thickness of the enamel film when designing mating extruded sections such as dovetail, contact, snap or sliding fits. Remember that mill tolerances vary for different types of extruded shapes.

Extrusion to be enameled should be free from die lines since they will be visible in the finished enameled coating. Carbon and other foreign matter must be removed before enameling.

ENAMEL VS. ANODIZING

What advantages does porcelain enamel have over color anodizing if color is the only requirement? Enamels have a greater range of colors, and the color retention is better. A permanent white can only be gotten with porcelain enamel. It's hard to get uniform shades of white, blue, black and green by anodizing, but it's easy with porcelain enamel. Enameling is more costly, but as the demand for it increases the cost should approach that of color anodizing.

Material for this article was contributed by the Reynolds' Metals Company.



NOW—A Great New Combination for DOUBLE PROTECTION Against Corrosive Conditions on Aluminum, Magnesium or Zinc

IRIDITE®
CHROMATE CONVERSION COATINGS
and
IRILAC™
CLEAR PROTECTIVE COATINGS

Now, here's a fast, easy, economical way to almost double the protection against corrosion on your product. Simply follow up the IRIDITE process with a fast, easy application of IRILAC . . . and you've given your product extra protection for longer resistance to corrosive conditions, longer shelf or storage life protection from handling, and increased beauty for more attractive appearance and faster sales.

ON ALUMINUM

An IRIDITE-IRILAC finish will provide longer life for storm doors, windows, outdoor furniture, auto parts and accessories, tubing or wire goods. And, you have a choice of color finishes such as natural aluminum and golden yellow. Other colors may be obtained by an additional dye operation.

ON MAGNESIUM

IRILAC over an IRIDITE No. 15 finish increases corrosion protection, and provides resistance to finger printing and abrasion on all types of products, with color appearance ranging from light to dark brown.

ON ZINC

IRIDITE plus IRILAC gives your product longer life and brighter appearance. Color choices range from clear IRIDITE to olive drab, plus colored dye finishes.

IRIDITE is the tradename for a specialized line of chromate conversion coatings that can be applied to any non-ferrous metal by brush, dip or spray methods—at room temperatures—manually or with automatic equipment. Upon application, a thin film forms which becomes an integral part of the metal itself, and thus cannot chip, flake or peel. No special equipment, exhaust systems or specially trained personnel are required.

IRILAC is the tradename for a line of clear protective coatings for all metals. As safe and easy to handle as water, they may be applied by brush, dip or spray methods. No exhaust or special fire protection equipment required. Adds protection and abrasion resistance to any base metal, plated part or parts treated with electrolytic or chemical post treatments, without chemical change.

For complete technical information on IRIDITE Chromate Conversion Coatings or IRILAC Clear Protective Coatings, write for FREE TECHNICAL MANUAL. Or, see the Allied Field Engineer in your area. He's listed under "Plating Supplies" in the yellow pages.

Allied Research Products, Inc.

4004-06 EAST MONUMENT STREET • BALTIMORE 5, MARYLAND
BRANCH PLANT: 400 MIDLAND AVENUE • DETROIT 3, MICHIGAN
West Coast Licensee for Process Chemicals: L. H. Butcher Co.

Chemical and Electrochemical Processes, Anodes, Rectifiers Equipment, and Supplies for Metal Finishing

IRIDITE® Chromate Coatings | IRILAC™ Clear Coatings | ISOBRITE® Plating Brighteners | ARP® Chemicals & Supplies | WAGNER Line of Equipment

Circle No. 73 on Reader Service Card

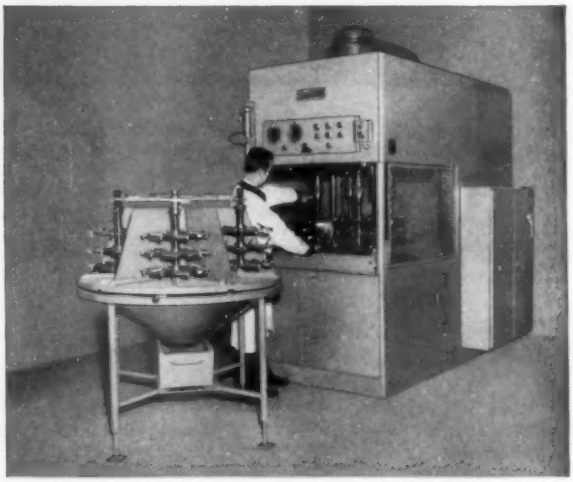
COMPARE Grav-i-Flo's Finishing Prior To Decorative Plating!

Grav-i-Flo Has Exclusive Materials To Produce Finishes Heretofore Impossible In The Tumbling Field—And On Nearly Every Shape And Size Part By These Two Processes:

TUMBLING

Grav-i-Flo exclusive barrel finishing materials make it possible to obtain finishes in a tumbling barrel that no other process can produce. Grav-i-Flo chips are the most outstanding of all barrel finishing medias on the market for decorative finishing. Many customers ultilize Grav-i-Flo's plant facilities for job tumbling of parts on which they have been unable to obtain satisfactory finishes—and then later install their own facilities.

SPIN-FINISH



Large parts, intricate shape parts not suited to tumbling and previously finished only by buffing, are now finished in production quantities to high lustre surfaces with Grav-i-Flo's Spin-Finish machines. This short, automatically timed operation offers tremendous savings in schedules, labor and floor space. No set-up time required for changing jobs. This is a completely dry process, dust and fume free, eliminating ventilating systems.

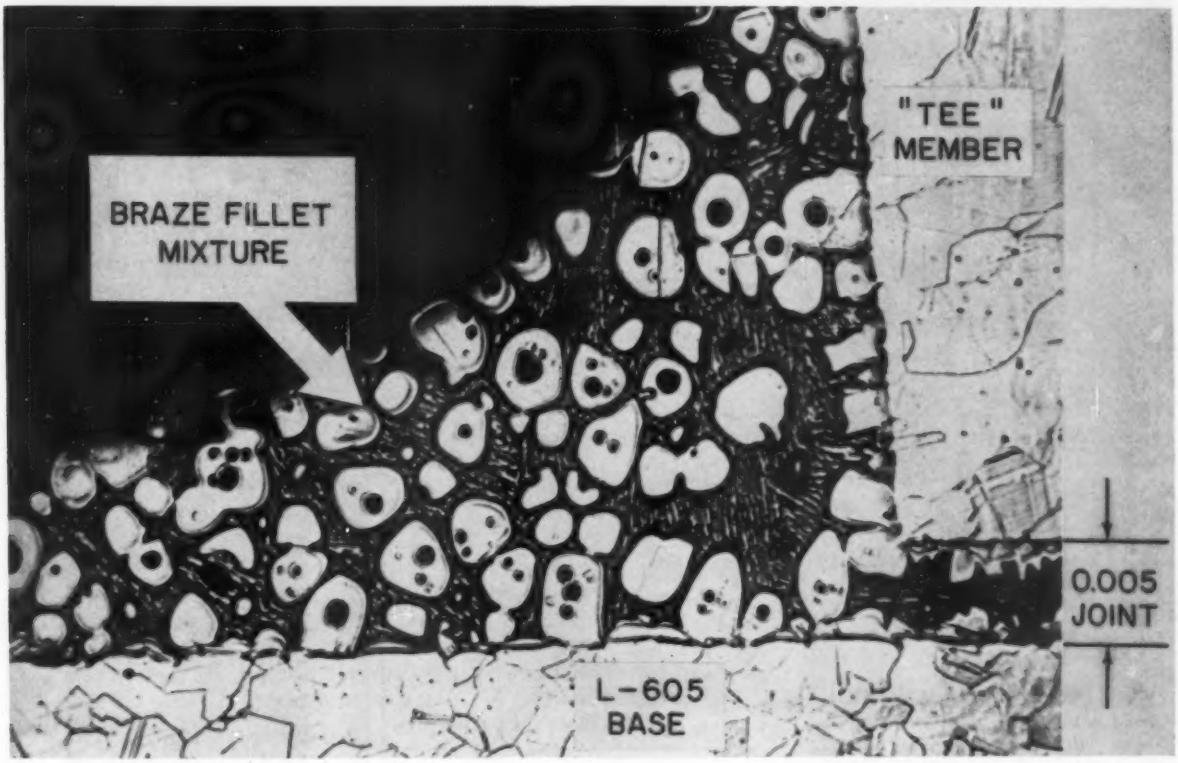
Check with Grav-i-Flo Engineering

for better finishes prior to decorative plating. Grav-i-Flo personnel were the pioneers—and are still the leaders in tumble finishing.

GRAV-I-FLO CORPORATION

Dept. PMM 4 - Sturgis, Michigan

Circle No. 75 on Reader Service Card



Powder metallurgy gives . . .

A NEW BRAZING TECHNIQUE

CALLED INSITU BRAZING, this development in powder metallurgy may be a solution to many difficult brazing problems.

By mechanically mixing a selected metal powder with brazing alloy powder, it is possible to produce brazed joints with special characteristics. The principle involved is diffusion of the selected metal powder into the liquid brazing alloy at the joint-in situ.

For example, nickel or nickel-chromium-iron alloy in powder form is thoroughly mixed with a high temperature brazing powder. A "Tee" joint such as the one shown in part in the figure is made.

When the braze metal flows it wets and begins to alloy with the refractory powder and the massive metal of the joint. Due to the very large surface areas presented by the refractory powder, rapid diffusion will take place between the filler metal and the braze metal. The sponge like nature of the fillet built up of powders will prevent flow-out. Only a small amount of braze metal fills the actual joint.

Some of the advantages of this method are:

1 Joints serviceable at higher temperatures.
2 Higher impact and fatigue properties of the joints due to larger fillets.
3 Tougher joints even with non-ductile brazing alloys.
4 Better control of size of both fillets and braze puddles.
5 Less erosion of the base metal.
6 Time-temperature relations are less critical.
7 Stop-off to prevent braze metal flow not needed.
8 Multiple brazing cycles are possible.
9 Repair techniques are extended.

Commercial applications of this method of brazing have not been numerous. Preliminary work indicates that this method may be a solution to many difficult or presently impossible brazing problems.

This report was taken from a much longer report on multiple brazing by George D. Cremer, senior staff engineer and Richard S. Mueller, research engineer, Solar Aircraft Co.

The Abbot asks you: What's right for your product... FINISH ...or CUT?

WHEN METAL PRODUCTS or parts need a polished, mirror-like, glass-hard *finish*, steel burnishing should be used . . . not synthetic abrasives, which have comparative application superiority only when *cutting* is what's wanted.

The high-quality steel shapes shown above on the top are products of the Abbott Ball Company, since 1909 the world's leading producer of steel finishing materials. Each different shape is designed for a special job.

SEND A SAMPLE of your product or part to us. Without charge, we'll conduct a thorough test and analysis on it, and return useful recommendations to you promptly.

Examining some samples after their test-run in the Abbott lab.

Write for copy of Bulletin AP-1

ABBOT® the Leader since 1909 1909-1960

THE ABBOTT BALL COMPANY

7 RAILROAD AVE. • HARTFORD 10, CONN.

Circle No. 72 on Reader Service Card

VACUUM CASTING

continued from page 47

chines, the cycling rate can be faster and production increased.

CURE-ALL?

No. Vacuum die casting of aluminum still remains a matter of dollars and cents. Vacuum opens new fields to aluminum die casting – both parts and materials.

In general, greater liberty can be taken with part design. Anodizable compositions can be successfully die cast. Improved tensile strength and uniformity makes thinner walls and less support-metal practical. Longer "arms" may extend from the main casting body. And as indicated by casting silicon compositions vacuum die casting can handle a wide range of fluidity. We have successfully cast compositions with a 50°F range of fluidity.

The field for aluminum die cast parts is broad – from thin, colorful, decorative automotive trim strips to cylinder blocks for drawing-board-stage, air-cooled, opposed-cylinder engines. Engineers can now specify vacuum cast aluminum parts – with all the inherent die casting advantages – for designs and compositions that could not even be considered previously.

NAME CHANGE FOR ASTE

The American Society of Tool Engineers has added the words "and Manufacturing" to its name. Effective immediately, the Society will become the American Society of Tool and Manufacturing Engineers.

In order to include those members whose responsibilities branch out into all fields of manufacturing engineering, the 40,000 member Society found the addition to its name a necessity.

Although the Society has been discussing the addition for some years, it was not until this year, with the support of its president, Wayne Ewing of Los Angeles, that the subject was put to a vote of the membership. They approved the addition by a substantial majority.

ASTME, whose headquarters are at 10700 Puritan in Detroit, has 162 senior and 29 student chapters.

invest in **KERR** *investments* **AND SAVE MONEY TOO!**

Modern manufacturing equipment, rigid quality control, assures uniformity from batch to batch.

KERR investments will fit your needs and cut production cost.

For Non-ferrous Metals

- **K-90**
- **DURACAST**
- **DURACAST-20**

For Ferrous Metals

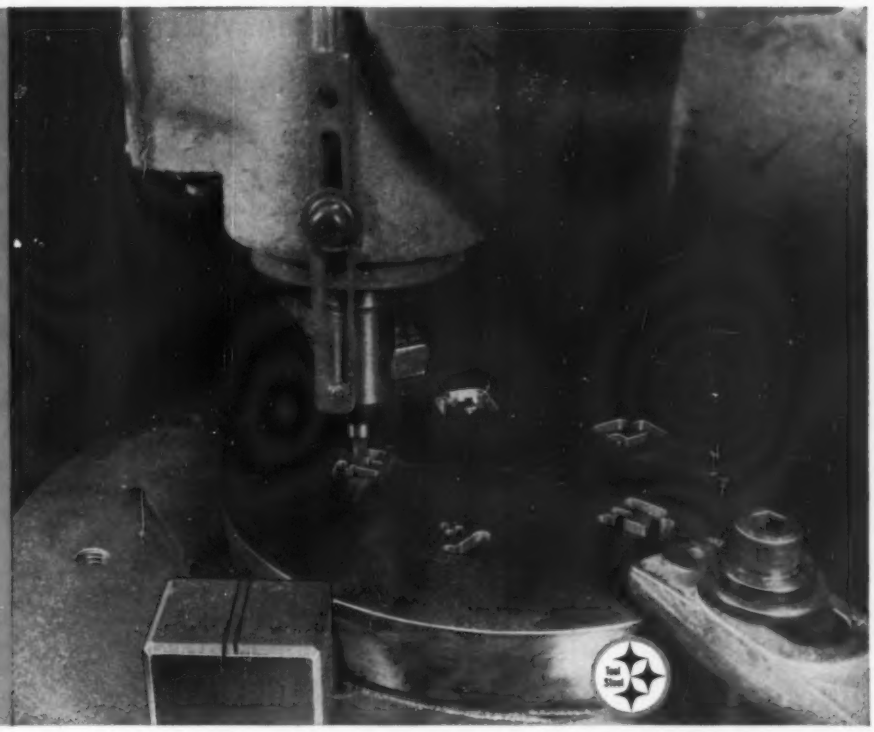
- **FERROMOLD**

KERR MANUFACTURING CO.
6081 Twelfth St.
Detroit 8, Michigan

Dealers
CASTING SUPPLY HOUSE
New York, New York
DICK ELLS CO.
Los Angeles, California

Circle No. 45 on Reader Service Card
PRECISION METAL MOLDING

Latrobe's EXTRUSION TOOL STEELS



Dependable... easy to machine... readily available in the size you need!

When your extrusion schedule calls for fast delivery of a die steel to do the job, you can cut production time by calling your nearby, fully-stocked Latrobe steel service center for prompt attention. Whether for regular run production or specialized application, there's a Latrobe grade and size practically at your fingertips.

Latrobe's Extrusion Tool Steels are always dependable . . . easy to saw, file and machine . . . Reflectoscope inspected to guarantee internal soundness . . . made to give you the kind of extrusion production service you want!

Wide range of stock sizes available in these grades:

- **LPD** • Type H-12 die steel
- **VDC** • Type H-13 die steel
- **VISCOUNT 20** • free-machining Type H-13 die steel
- **VISCOUNT 44** • prehardened, machinable Type H-13 die steel

Call your Latrobe steel service center today for prompt service and technical assistance . . . or write for literature about individual grades.

MEMBER OF AEC ALUMINUM EXTRUDERS COUNCIL

Skillfully made in U.S.A. by . . .

LATROBE Metalmasters

LATROBE STEEL COMPANY
LATROBE, PENNSYLVANIA

BRANCH OFFICES and STEEL SERVICE CENTERS: BOSTON • BUFFALO • CHICAGO CLEVELAND • DAYTON • DETROIT • GRAND RAPIDS • HARTFORD • LOS ANGELES • MIAMI MILWAUKEE • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN LEANDRO • TOLEDO YOUNGSTOWN

Circle No. 106 on Reader Service Card

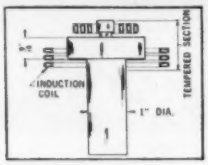
LepeL

HIGH FREQUENCY INDUCTION HEATING UNITS

HARDENING · ANNEALING
BRAZING · SOLDERING

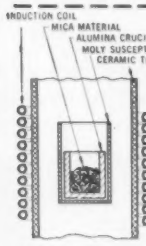
Lepel induction heating equipment represents the most advanced thought in the field of electronics ... the most practical and efficient source of heat developed for numerous industrial applications. You are invited to send samples of work with specifications. Our engineers will process and return the completed job with full data and recommendations without cost or obligations.

TYPICAL INDUCTION HEATING APPLICATIONS



Punch Heads Selectively Tempered

Diagram shows arrangement for selectively tempering heads of alloy steel punches. The use of a combination type solenoid and pancake induction coil reduces hardness from Rc 55/56 to Rc 41/44, improving resistance to brittle fracture at the head of the punch. In this case a heating cycle of 55 seconds provides uniform tempering. A multiple position fixture, processing 4 pieces at one time, speeds up production.



Heating Non-Conducting Materials To High Temperatures

Laboratory analyses frequently require heating of non-conducting materials to temperatures of 3,000 to 3,500° F. in vacuum or special atmosphere. This can be accomplished by induction heating with the aid of a metal susceptor. Diagram shows the fusion of mica samples in an alumina crucible, using molybdenum susceptor. A ceramic tube surrounding the susceptor isolates the work for fusion in a vacuum. The molybdenum susceptor is heated by induction, which in turn, heats the crucible by radiation.

WRITE FOR NEW LEPEL CATALOG
Electronic Tube Generators from 1 Kw to 100 Kw.
Spark Gap Converters from 2 Kw to 30 Kw.

LepeL HIGH FREQUENCY LABORATORIES, INC.
55th ST. & 37th AVE., WOODSIDE 77, N. Y.

Circle No. 48 on Reader Service Card

PANGBORN FORMS VIBRATORY FINISHING DIV.

BRANDT

Pangborn Corporation, Hagerstown, Maryland manufacturer of blast cleaning, abrasive and dust control equipment has announced the establishment of a new Vibratory Finishing Division.

The new corporate division, located at the company's Hagerstown headquarters, is headed by William E. Brandt who has been appointed a Pangborn Div. manager. Mr. Brandt is widely known in the precision finishing field.

Pangborn has designed a new line of finishing machines and will soon announce details on exclusive features said to effect significant improvements. All of the Pangborn machines are based on the principle of air cushioned vibration which, among its other advantages, has proved its ability to speed precision finishing by up to one hundred times.

In addition, Pangborn is now marketing a full line of precision barrel finishing and vibratory finishing media and compounds.

DORST DIV., ARNHOLD CERAMICS MOVES

The Dorst Division of Arnhold Ceramics, Inc., has moved its Engineering and Technical Department to larger quarters at 1952 Woodbridge Avenue, Nixon, New Jersey. This new move was made because of the increase in demand for Dorst high efficiency automatic presses for application in the ceramic, metal powder and allied fields.

These new quarters will provide Dorst customers with a new efficient service department with complete spare parts facilities.

SHAPE

A PROBLEM SOLVED BY

HUMCO

HUMPHREY CASTINGS, INC.
3944 RILEY STREET
SAN DIEGO 10, CALIFORNIA
CYpress 6-6173

No matter what your investment casting problem, HUMCO can solve it. Complex shapes are readily produced. High tolerances are routine. We handle parts weighing from a few grams to 25 pounds in an extremely wide range of alloys. Physical properties meet or surpass Federal and military specs.

WE CAN DO IT

Our extensive facilities and wealth of experience enable us to produce exactly what you want in a precision casting. Deliveries average about 10 days after tooling but much faster in emergencies. Our quality control procedures have Air Force cognizance

WANT TO BUY THE FINISHED PRODUCT?

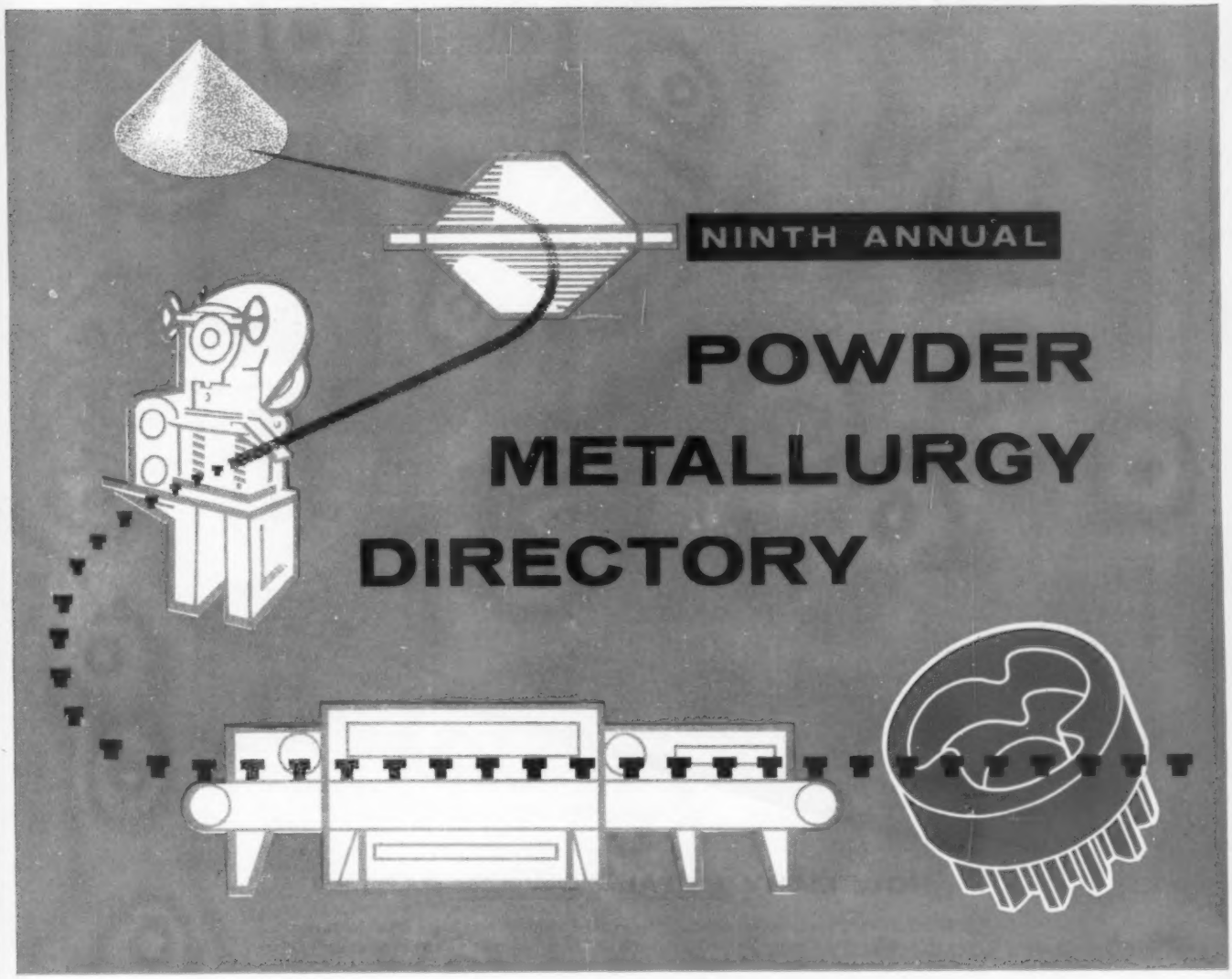
We'll perform any degree of finishing, right up to delivering the completed product.

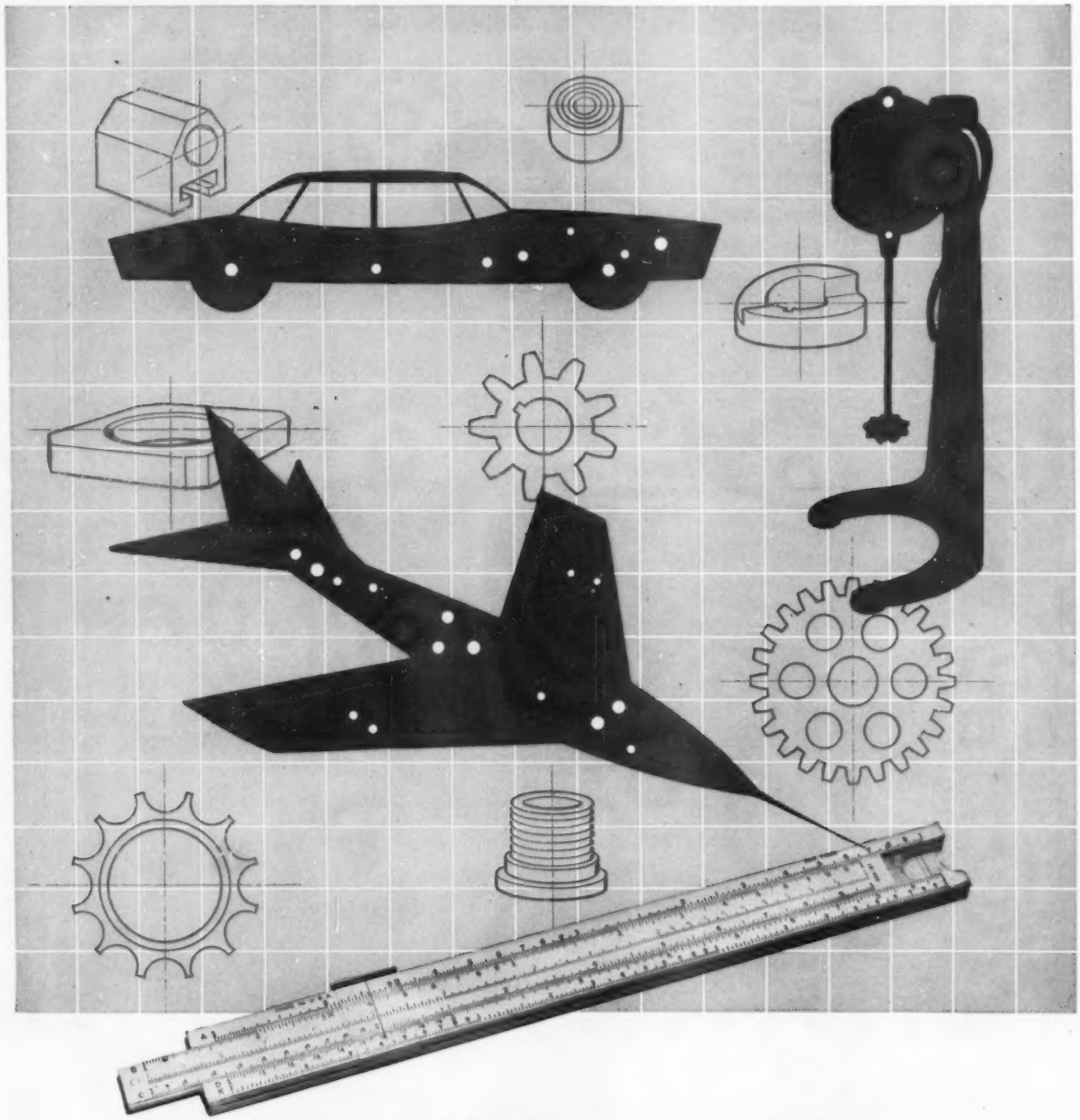
HUMCO also offers product research, development and design services.

SEND FOR FREE HUMCO FACILITY & PRODUCT BROCHURE

Circle No. 103 on Reader Service Card

PMM





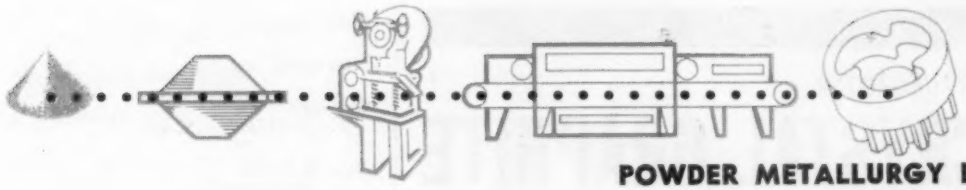
HOW MANY METAL POWDER PARTS?

Metal powder applications continue to expand as more and more manufacturers put powder metallurgy to work. Today's product designer has at his disposal an almost endless number of applications for metal powders. Industry has discovered that the process results in savings in material, manpower and equipment . . . while improving the quality and uniformity of the various fabricated parts.

Metals Disintegrating Company is prepared to supply any manufacturer, anywhere in the world, a specific grade of powder in aluminum, tin, copper, plus other metals or alloy powders in a wide range of particle sizes. In addition, our laboratory facilities are at your disposal to help you select the correct grade and material for your product.

METALS DISINTEGRATING COMPANY
Division of American-Marietta Company
General Offices, Department O, Elizabeth B, N. J.

Circle No. 85 on Reader Service Card



COMPONENT FABRICATORS

Bearings

Allied Sinterings, Inc.

American Powdered Metals, Inc.

American Sinteel Corporation
A Sub. of Mueller Brass Co.

Asco Sintering Corp.

The Bassick Company

Bound Brook Oil-Less Bearing Co.

Brockway Pressed Metals, Inc.

Bunting Brass & Bronze Co.

Carbon City Products Co., Inc.

Ceromet, Inc.

Chicago Powdered Metal Products Co.

Chrysler Corp.
Amplex Div.

Cleveland Graphite Bronze
Div. of Clevite Corporation

Cleveland Powder Metals Co.

Clevite Ltd.

Compacted Metals Corp.

Detroit Aluminum & Brass Corp.

Deva-Metal Div.
SKC Research Associates

Dixon Sintaloy, Inc.

Eaton Mfg. Co.
Powdered Metals Div.

Elco Sintered Alloys Co., Inc.

Engineered Plastics, Inc.

Federal-Mogul-Bower Bearings, Inc.

Ferro Powdered Metals, Inc.

Ford Motor Co.

Delco Moraine Div.
General Motors Corp.

General Sintering Corp.

Haller, Inc.

Indar Corp.

International Powder Metallurgy Co.

International Powder Metallurgy, Inc.
Rocky Mountain Metals Div., Inc.

Johnson Bronze Co.

Keystone Carbon Co.

Kulite Tungsten Co.

Kwikset Powdered Metal Products
Kwikset Division, American Hardware Corp.

A. B. McMahan Co.

Merriman Brothers, Inc.

Metal Ceramics Powdered Metal Products

Metal Powder Products, Inc.

National Molded Products, Inc.

Norwalk Powdered Metals, Inc.

Pacific Sintered Metals Co.

Parker White-Metal Co.

Perth Metal Industries Ltd.

Picco, Inc.

Powder Metals Research, Inc.

Powdercraft Corp.

Precision Metal Products Co.

The Presmet Corporation

Reese Metal Products Corp.

Romanoff Machine & Tool Co.

St. Marys Carbon Co.

Sintered Metals, Inc.

Standard Carbon Co.

Sterling Engineering Corp.

Superior Carbon Products, Inc.

Symmco, Inc.

Technametals, Inc.

United States Graphite Co.
Div. of the Wickes Corp.

Wakefield Bearing Corporation

Western Sintering Co.

Cores

The Arnold Engineering Co.

Engineered Plastics, Inc.

General Ceramics Corp.

Kwikset Powdered Metal Products
Kwikset Division, American Hardware Corp.

Magnetic Core Corporation

Micrometals

National Moldite Co.

Neosid (Canada) Ltd.

Norwalk Powdered Metals, Inc.

Pyroferric Co., Inc.

A. O. Smith Corp.
Crowley Div.

Stackpole Carbon Co.

Contact Materials

Engelhard Industries, Inc.
Baker Contact Div.

Fansteel Metallurgical Corporation

General Carbon Company

General Sintering Corp.

Gibson Electric Co.

Kulite Tungsten Co.

Mallory Metallurgical Co.
Div. of P. R. Mallory & Co., Inc.

Powder Metals Research, Inc.

St. Marys Carbon Co.

Stackpole Carbon Co.

Superior Carbon Products, Inc.

Technametals, Inc.

Cemented Carbides

Adamas Carbide Corp.

Allegheny Ludlum Steel Corp.

Carbide, Inc.

Firth Sterling, Inc.

General Electric Co.
Metallurgical Products Dept.

General Sintering Corp.

use Southwestern

MICROCRYSTAL GRAPHITE

for Copper and Bronze Compositions and for Increased Hardness In Structural Iron Parts

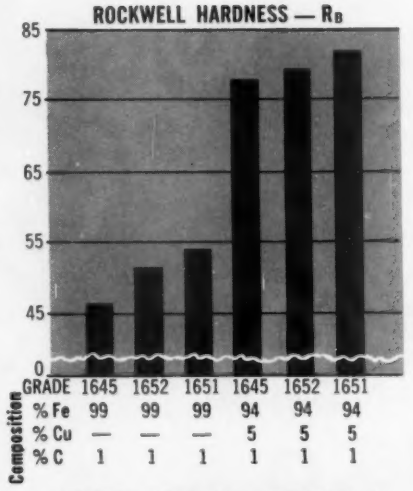
SINTERED PROPERTIES

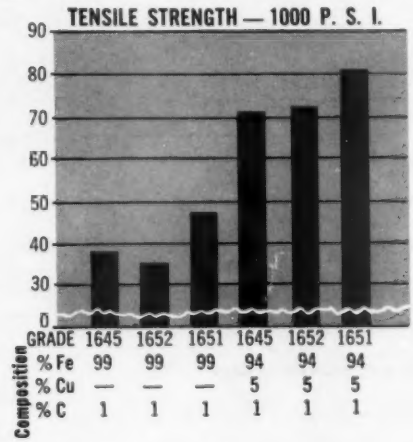
of Iron-Microcrystal Graphite and Iron-Copper-Microcrystal Graphite Compositions

M P I Standard Bars — Sintered at 2050°F — 10 min. Atmosphere of Cracked Ammonia — Continuous Production Furnace

TOTAL CARBON AFTER SINTERING	GREEN DENSITY
Grade 1645—.81%	6.4 gm/cc
Grade 1652—.84%	ELONGATION (% in 1")
Grade 1651—.86%	99% Fe—1% C
	Grade 1645—2.5
	Grade 1652—2.0
	Grade 1651—3.0

Send for a test sample (no charge) of one or all Grades of Microcrystal Graphite.





Microcrystal

a product of

SOUTHWESTERN GRAPHITE COMPANY

GRAPHITE ROAD, BURNET, TEXAS

Circle No. 64 on Reader Service Card

Indar Corp.

Kennametal, Inc.

Sintercast
Div. of Chromalloy Corp.

Valenite Metals
Div. of Valeron Corp.

Vascoloy-Ramet Corporation

Electrical Components

Allied Sinterings, Inc.

American Powdered Metals, Inc.

American Sinteel Corporation
A Sub. of Mueller Brass Co.

Asco Sintering Corp.

Carbon City Products Co., Inc.

Ceromet, Inc.

Chicago Powdered Metal Products Co.

Cleveland Powder Metals Co.

Compacted Metals Corp.

Custom Components, Inc.

Dixon Sintaloy, Inc.

Engelhard Industries, Inc.
Baker Contact Div.

Engineered Plastics, Inc.

Ferro Powdered Metals, Inc.

General Carbon Company

General Sintering Corp.

Gibson Electric Co.

Haller, Inc.

Handy & Harman

Indar Corp.

International Powder Metallurgy Co.

International Powder Metallurgy, Inc.
Rocky Mountain Metals Div., Inc.

Johnson Bronze Co.

Kwikset Powdered Metal Products
Kwikset Division, American Hardware Corp.

Merriman Brothers, Inc.

Metal Ceramics Powdered Metal Products

Metal Powder Products, Inc.

Pacific Sintered Metals Co.

Picco, Inc.

Powder Alloys Corp.

Powdercraft Corp.

The Presmet Corporation

Reese Metal Products Corp.

St. Marys Carbon Co.

Sintered Metals, Inc.

A. O. Smith Corp.
Crowley Div.

Stackpole Carbon Co.

Standard Carbon Co.

Sterling Engineering Corp.

Wakefield Bearing Corporation

Filters

Arrow Sintered Products Co.

Asco Sintering Corporation

Chrysler Corporation
Amplex Div.

Metal Ceramics Powdered Metal Products

Norwalk Powdered Metals ,Inc.

Precision Metal Products Co.

St. Marys Carbon Co.

Friction Materials

Asco Sintering Corp.

Bendix Aviation Corp.

Chrysler Corp.
Amplex Div.

Ferro Powdered Metals, Inc.

General Metals Powder Co.

General Sintering Corp.

International Powder Metallurgy Co.

Kwikset Powdered Metal Products
Kwikset Div., American Hardware Corp.

National Molded Products, Inc.

Powdercraft Corp.

Raybestos-Manhattan, Inc.
Manhattan Rubber Div.

Raybestos-Manhattan, Inc.
Wabash Div.

Stackpole Carbon Co.

The S. K. Wellman Co.

Magnetic Materials

American Powdered Metals, Inc.

American Sinteel Corporation
A Sub. of Mueller Brass Co.

The Arnold Engineering Co.

Asco Sintering Corp.

Brockway Pressed Metals, Inc.

Ceromet, Inc.

Dixon Sintaloy, Inc.

Engineered Plastics, Inc.

Ferro Powdered Metals, Inc.

Ferroxcube Corp. of America

General Ceramics Corp.

General Electric Co.
Metallurgical Products Dept.

Delco Moraine Div.
General Motors Corp.

General Sintering Corp.

Indar Corp.

The Indiana Steel Products Co.
Div. of Indiana General Corp.

International Powder Metallurgy Co.

Kwikset Powdered Metal Products
Kwikset Division, American Hardware

Merriman Brothers, Inc.

Metal Powder Products, Inc.

National Moldite Co.

Neosid (Canada) Ltd.

A. JOHNSON & CO., INC.

ELECTROLYTIC IRON POWDER AND POWDER COMPACTING PRESSES

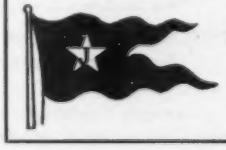
A. Johnson & Co., Inc. is an American corporation affiliated with the Johnson concern in Sweden, whose industrial activities are world wide. During the past decade we have supplied the powder metallurgy industry with quality products and service. Our efforts will continue to grow with the increasing pace of the industry. At present, the powder production capacity is being expanded to anticipate these increasing requirements. We cordially invite you to visit our booth (No. 31) at the Metal Powder Industries Federation Show in Chicago April 25-27th to discuss how A. Johnson can be of assistance to you.

ELECTROLYTIC IRON POWDER

- HVA Star Grade:
  apparent density 2.6 -2.8 gms/cc
- MSS Standard Grade:
  apparent density 3.2 - 3.4 gms/cc
- MSH Heavy Grade:
  apparent density 3.8-3.9 gms/cc

COMPACTING PRESSES

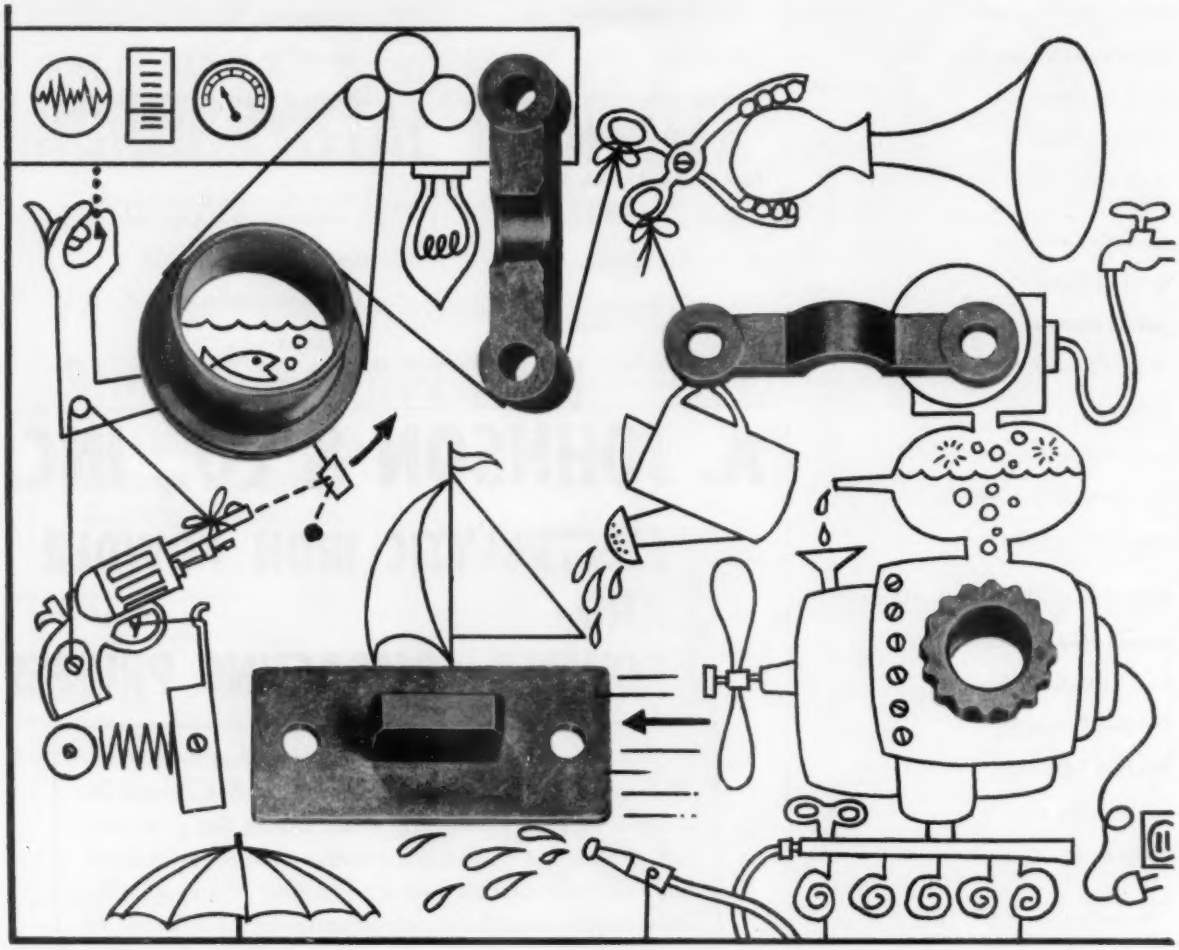
Soenen	Spiertz
6-220 tons capacity	330-1100 tons capacity
eccentric type	knuckle type



A. JOHNSON & CO., INC.
21 West Street
New York 6, New York

MEMBER METAL POWDER mpi INDUSTRIES FEDERATION

Circle No. 43 on Reader Service Card



This thing wouldn't run when we plugged it in,

BUT, WE'D LIKE TO SEND YOU THE PIECES*

. . . to introduce you to parts made from superior Glidden Resistox Metal Powders.

You may find that metal powder parts similar to these, or perhaps in entirely different form, can mean substantial savings in manufacture of your products.

Glidden Resistox Metal Powders are prepared by a special process which removes *all* soluble salts, resulting in pure, stable powders for highest finish, appearance and performance characteristics.

Glidden is the world's largest blender and can produce up to 30,000 pounds of powder in a single batch —an important factor in complete uniformity of mass-produced parts.

As a leading supplier of metal powders, Glidden works closely with parts producers. This places the combined training and experience of several staffs of metallurgists and technicians at your disposal.

**Write on your letterhead for sample parts package and further information on powdered metal products.*

QUALITY Glidden PRODUCTS

RESISTOX METAL POWDERS

The Glidden Company
Chemical Divisions, Metals Department
Hammond, Indiana

COPPER POWDER • LEAD POWDER • TIN POWDER • BRASS POWDER • ALLOY POWDER • FILTER POWDER
CUPRIC OXIDE • CUPROUS OXIDE • CUPROUS SULFIDE • CUBOND COPPER BRAZING PASTE • COPPER PIGMENT

Circle No. 34 on Reader Service Card

Norwalk Powdered Metals, Inc.

Pacific Sintered Metals Co.

Powdercraft Corp.

The Presmet Corporation

Sintered Metals, Inc.

A. O. Smith Corp.

Stackpole Carbon Co.

Sterling Engineering Corp.

Structural Parts

Allied Sinterings, Inc.

American Powdered Metals, Inc.

American Sinteel Corporation
A Sub. of Mueller Brass Co.

Arrow Sintered Products Co.

Asco Sintering Corp.

The Bassick Company

Bound Brook Oil-Less Bearings Co.

Brockway Pressed Metals, Inc.

Bunting Brass & Bronze Co.

Burgess-Norton Mfg. Co.

ATTENTION
ALL DIE CASTERS!

- For advanced engineering in fully automated die casting machines...
- For lowest cost, production-proved automatic ladling for aluminum and vacuum die evacuation (Morton system)...

investigate

CLEVELAND DIE CASTING MACHINES

THE CLEVELAND AUTOMATIC MACHINE COMPANY
4952 Beech St., Cincinnati 12, Ohio

Circle No. 19 on Reader Service Card

Carbon City Products Co., Inc.

Ceromet, Inc.

Chicago Powdered Metal Products Co.

Chrysler Corp.
Amplex Div.

Cleveland Powder Metals Co.

Clevite Ltd.

Compacted Metals Corp.

Dixon Sintaloy, Inc.

Eaton Mfg. Co.
Powdered Metals Div.

Elco Sintered Alloys, Inc.

Engineered Plastics, Inc.

Ferro Powdered Metals, Inc.

Ford Motor Company

Delco Moraine Div.
General Motors Corp.

General Sintering Corp.

Gibson Electric Co.

Globe Industries, Inc.
Supermet Division

Haller, Inc.

Indar Corp.

International Powder Metallurgy Co.

International Powder Metallurgy, Inc.
Rocky Mountain Metals Div., Inc.

Johnson Bronze Co.

Keystone Carbon Co.

Kwikset Powdered Metal Products
Kwikset Div., American Hardware Corp.

Link-Belt Co.

Lux Clock Mfg. Co.

Mallory Metallurgical Co.
Div. of P. R. Mallory & Co., Inc.

A. B. McMahan Co.

Merriman Brothers, Inc.

Metal Ceramics Powdered Metal Products

Metal Powder Products, Inc.

Midwest Sintered Products Corp.

National Molded Products, Inc.

National Moldite Co.

Norwalk Powdered Metals, Inc.

Pacific Sintered Metals Co.

Parker White-Metal Co.

Perth Metal Industries Ltd.

Picco, Inc.

Powdercraft Corp.

Precision Metal Products Co.

The Presmet Corporation

Reese Metal Products Corp.

Remington Arms Co., Inc.

Romanoff Machine & Tool Co.

St. Marys Carbon Co.

Sintered Metals, Inc.

Standard Carbon Co.

Sterling Engineering Corp.

Superior Carbon Products, Inc.

Symmco, Inc.

Technametals, Inc.

United States Graphite Co.
Div. of The Wickes Corp.

Wakefield Bearing Corp.

Western Sintering Co.

EQUIPMENT

Anhydrous Ammonia

Allied Chemical & Dye Corporation

Armour Industrial Chemical Co.
Div. of Armour & Co.

Henry Bower Chemical Mfg. Co.

E. I. DuPont de Nemours & Co.

Hamler Industries, Inc.

Midland Ammonia Co.

Monsanto Chemical Company

Olin Mathieson Chemical Corporation

Atmosphere Generators

Continental-Industrial Engineers

The Drever Co.

The Electric Furnace Co.

Ferguson Equipment Corp.

The Gas Machinery Co.

General Electric Co.
Apparatus Sales Div.

C. I. Hayes, Inc.

Hevi-Duty Electric Co.

Holcroft & Co.

The C. M. Kemp Mfg. Co.

Lindberg Engineering Co.

Sunbeam Equipment Corp.

Surface Combustion
Div. of Midland-Ross Corp.

Dies & Tools

Adamas Carbide Corp.

Allegheny Ludlum Steel Corp.

Champion Tool & Die Co.

Sintercast
Div. of Chromalloy Corp.

Cleveland Tool & Die Co.

Arthur Colton Co.

Diecraft Tool Co.

Elizabeth Carbide & Die Co., Inc.

Firth Sterling, Inc.

General Electric Co.
Metallurgical Products Dept.

Gentry Carbide Tool & Die Co.

Kennametal, Inc.

Major Gauge & Tool Co.

Micro-Carbide Tool & Die Co., Inc.

Monarch Tool and Gauge Co.

National Carbide Die Co.

John E. Skach Tool Co.

F. J. Stokes Corp.

Valenite Metals
Div. Valeron Corp.

Vascoloy-Ramet Corporation

Welded Carbide Tool Co., Inc.

Furnaces

Continental-Industrial Engineers

The Drever Co.

The Electric Furnace Co.

Falcon Equipment Co.

Ferguson Equipment Corp.

The Gas Machinery Co.

General Electric Co.
Apparatus Sales Div.

Harper Electric Furnace Corp.

C. I. Hayes, Inc.

Hevi-Duty Electric Co.

Holcroft & Co.

Leeds & Northrup Co.

Lindberg Engineering Co.

Mannesmann-Meer, Inc.

Perany Equipment Co.

Posey Iron Works, Inc.

Sargeant & Wilbur, Inc.

The Sentry Company

F. J. Stokes Corp.

Sunbeam Corporation
Industrial Furnace Division

Sunbeam Equipment Corp.

Surface Combustion
Div. of Midland-Ross Corp.

Taunton Engineering Works

Impregnating Equipment

American Metaseal Corp.

Curd Enterprizes, Inc.
Multiplastics Div.

Imprex, Inc.

F. J. Stokes Corp.

Laboratory Equipment

Haller, Inc.

Loomis Engineering & Mfg. Co.

Metals Disintegrating Co., Inc.

Lubricants

Acheson Colloids Company

American Oil & Supply Co.

American Cyanamid Co.

Capital City Products Co.

Joseph Dixon Crucible Co.

Foote Mineral Co.

Nopco Chemical Co.

M. W. Parsons-Plymouth, Inc.

Witco Chemical Company

Mixing Equipment

Baker Perkins, Inc.

Read Standard Division
Capitol Products Corporation

Arthur Colton Co.

J. H. Day Co.
Div. of Cleveland Automatic Machine Co.

International Engineering, Inc.

Mannesmann-Meer, Inc.

Mercer-Robinson Co., Inc.

Read Standard Corp.
Sturtevant Mill Co.

Taunton Engineering Works

Presses

Arnold Ceramics, Inc.
Dorst Div.

Baldwin Lima Hamilton Corporation
Industrial Equipment Division

B.I.P. Engineering Ltd.
Ralph B. Symons Associates, Inc.

E. W. Bliss Co.

Clifton Hydraulic Press Co.

Arthur Colton Co.

Elmes Engineering Div.
American Steel Foundries

Haller, Inc.

Hannifin Co.
Div. of Parker-Hannifin Corporation

International Sales Management Co.
Fawcett Div.

A. Johnson & Co., Inc.

Johnson Machine & Press Corp.

Kux Machine Co.

Loomis Engineering & Mfg. Co.

M & N Modern Hydraulic Press Co.

Mannesmann-Meer, Inc.

The Minster Machine Co.

F. J. Stokes Machine Corp.

Walsh Press & Die Co.

Pyrometric Equipment

Barber-Colman Co.
Wheelco Instruments Div.

R. A. Ekstrom Co.

Ferguson Equipment Corp.

General Electric Co.
Apparatus Sales Div.

Claud S. Gordon Co.

Illinois Testing Laboratories, Inc.

Leeds & Northrup Co.

Minneapolis-Honeywell Regulator Co.

The Pyrometer Instrument Co., Inc.

Arklay S. Richards Co., Inc.

TODAY AND TOMORROW

whatever may be your problems

BUNTING®

BEARINGS *Supply the answers*

...Cast Bronze Alloys...Powdered Sintered Metals...Bearing Aluminum Alloys

Why pay more for a bearing or part than you have to? Let Bunting help you get your requirements down on the lowest cost level compatible with adequate performance.

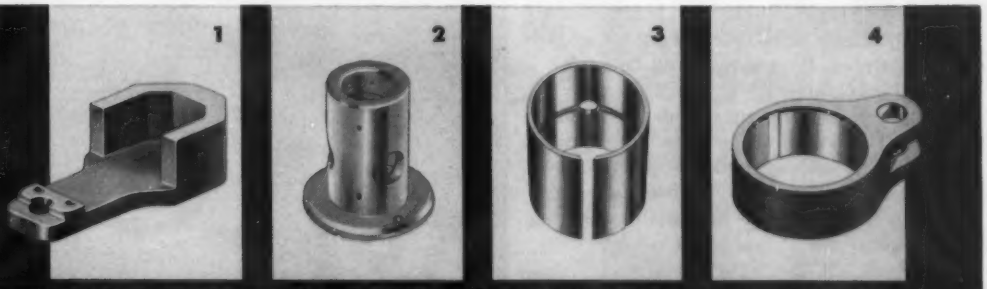
Today and tomorrow "the best" bearing means one that will do the job at the lowest possible cost. Let Bunting help you find the best bearing.

Bunting offers a highly competent designing, engineering and manufacturing facility operating in the field of bearings and special parts.

All modern proven materials are available, others are under study. Two plants with advanced equipment—of our own design—assure absolute production control and lowest manufacturing cost.

Let us re-examine your current bearing applications, or work with you on new requirements. Send in your prints for study and pricing. No cost nor obligation.

CASE IN POINT



1 The great and diverse cost advantages of powder metallurgy are revealed in the highly complex nature of this bearing support plate for power tools made in Bunting's Powdered Sintered Metals Plant.

2 An Aluminum Alloy helped cut the cost of this high speed turbo super charger bearing with its intricate machining of many dimensions and close tolerances.

3 Bunting exclusive methods and equipment reduced to the minimum the cost of this cast bronze spindle bearing with its extremely rigid specifications.

4 This connecting rod demands a fine profilometer reading on the finish of the bores in the two holes, axes of which must be parallel to each other within extremely close limits. Bunting makes such high precision work feasible cost-wise.

MACHINING SERVICE: Emergency service machine shops in Bunting Branches are there to render immediate low cost service on bearings or parts needed for experiment or maintenance. Your local Bunting Distributor can arrange for such service.

Write for these:

No. 46—TECHNOLOGY OF BUNTING BEARING ALUMINUM—A technical treatise on the composition and machining of Bearing Aluminum Bar Stock.

No. 1 . . . ENGINEERING HANDBOOK OF POWDER METALLURGY—A comprehensive technical treatment of engineering and manufacturing of sintered metals, bearings and parts.

No. 158—GENERAL CATALOG—Complete listings of Cast Bronze and Sintered Bronze Stock Bearings and Bars and Bunting Bearing Aluminum Bars available from stocks of local distributors all over America.

THE BUNTING Brass and Bronze Company · Toledo 1, Ohio · Phone EVergreen 2-3451

BEARINGS, BUSHINGS, BARS AND SPECIAL PARTS OF CAST BRONZE, SINTERED METALS OR ALUMINUM ALLOYS

Circle No. 13 on Reader Service Card

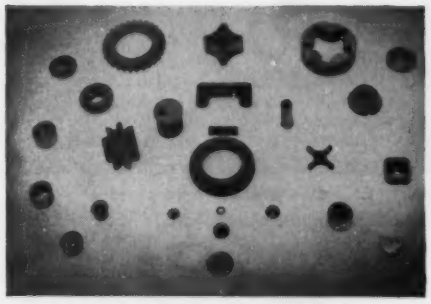
For profitable production...

THE HIGH-SPEED BALDWIN COMPACTING PRESS

This versatile 75-ton compacting press can increase your profits through high-speed production and economical operation. Uniform die pressure, fast cycling, and 4-point guiding assure quick, accurate processing—whether of powdered metals, ceramics, abrasives, carbides, cermets, ferrites or nuclear and other solid fuels for rockets and missiles.

Motions and controls, integral with the unit, permit use of simple die sets to produce intricate parts. Hand wheels provide complete range adjustment of fill, punch entrance and ejection strokes. Present tools can be easily adapted because of readily accessible die space.

Another Baldwin advantage goes with it all. Expanded facilities at our new Industrial Equipment Division assure early delivery and continued high standards of manufacture. Write us for detailed information and specifications.



Some of the many fabricated parts formed on Baldwin compacting presses.

BALDWIN · LIMA · HAMILTON

Industrial Equipment Division · Philadelphia 42, Pa.

Circle No. 12 on Reader Service Card

Service Associated, Inc.

West Instrument Corporation

The Winslow Co., Inc.

Sizing Equipment

Arthur Colton Co.

J. H. Day Co.
Div. of Cleveland Automatic Machine Co.

The Exolon Co.

Mercer-Robinson Co., Inc.

F. J. Stokes Corp.

Sturtevant Mill Co.

Taunton Engineering Works

The W. S. Tyler Co.

POWDER SUPPLIERS

Aluminum

Aluminum Company of America

Belmont Smelting & Refining Works, Inc.

Charles Hardy, Inc.

Metal Atomizing & Processing Corp. Ltd.

Metals Disintegrating Co., Inc.

Reynolds Metals Co.

U. S. Bronze Powder Works, Inc.

Brass

Belmont Smelting & Refining Works, Inc.

The Glidden Co.

Charles Hardy, Inc.

Metal Atomizing & Processing Corp. Ltd.

New Jersey Zinc Co.

U. S. Bronze Powder Works, Inc.

Copper

American Metal Climax, Inc.

Belmont Smelting & Refining Works, Inc.

The Glidden Co.

Greenback Industries, Inc.

Charles Hardy, Inc.

Malone Metal Powders, Inc.

Metal Atomizing & Processing Corp. Ltd.

Metals Disintegrating Co., Inc.

New Jersey Zinc Co.

U. S. Bronze Powder Works, Inc.

Whitaker Metals Corp.

Iron

Alan Wood Steel Co.

Antara Chemicals, A Sales Div. of General Aniline & Film Corporation (Carbonyl only)

Plastic Metals Division
The Crane Company

Easton Metal Powder Co., Inc.

Foote Mineral Company

Freeman Corporation

Charles Hardy, Inc.

Hoeganaes Sponge Iron Corporation

The International Nickel Co., Inc.
(Carbonyl only)

A. Johnson & Co., Inc.

Kulite Tungsten Co.

Magnetic Powders, Inc.

Metal Powders, Inc.

Metal Atomizing & Processing Corp. Ltd.

Powder Metals Research, Inc.

Pyron Corp.

PLYMOUTH

METALLIC

STEARATES

The most efficient lubricants for powdered metal molding. Reduces molding and ejection pressure. Improves metal powder flow characteristics. Controls part density. Prolongs die life.

Write for samples and data.

M. W. PARSONS-PLYMOUTH, INC.
59 BEEKMAN STREET, NEW YORK 38, N.Y.
Telephone: BEEKMAN 3-3167—3163—3164
Cable: PARSONOILS, NEW YORK
DISTRIBUTION POINTS AND AGENTS IN ALL PRINCIPAL CITIES

Circle No. 60 on Reader Service Card

PYRON

THE IRON POWDER

that makes the difference

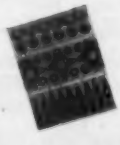
IN

BEARINGS

STRUCTURAL PARTS

ELECTRONIC USES

FRICTION MATERIALS



ALSO IRON POWDERS FOR: • METALLURGICAL USES • WELDING ELECTRODES • SEED CLEANING • CUTTING WHEELS • PHARMACEUTICAL USES AND ALLOY AND IRON POWDERS TO SPECIFICATIONS

Send for Data Sheets

PYRON CORP.

BOX 426 LA SALLE STATION • NIAGARA FALLS, N. Y.

Circle No. 58 on Reader Service Card

Republic Steel Corporation
Metal Powder Division

Vanadium-Alloys Steel Co.

C. K. Williams & Co.

Lead

Belmont Smelting & Refining Works, Inc.

The Glidden Co.

Charles Hardy, Inc.

Metal Atomizing & Processing Corp. Ltd.

Metals Disintegrating Co., Inc.

National Lead Co.

Nickel

Belmont Smelting & Refining Works, Inc.

Plastic Metals Division
The Crane Company

Foote Mineral Company

Charles Hardy, Inc.

Hoeganaes Sponge Iron Corp.

The International Nickel Co., Inc.

Metal Atomizing & Processing Corp. Ltd.

Metals Disintegrating Co., Inc.

National Lead Co.

Pyron Corp.

Sherritt Gordon Mines Ltd.

Vanadium-Alloys Steel Co.

Nickel Silver

Charles Hardy, Inc.

Metal Atomizing & Processing Corp. Ltd.

New Jersey Zinc Co.

U. S. Bronze Powder Works, Inc.

Steel

Charles Hardy, Inc.

Hoeganaes Sponge Iron Corporation

Metal Atomizing & Processing Corp. Ltd.

Metal Powders, Inc.

Micronized Metals, Inc.

Pyron Corp.

Republic Steel Corporation
Metal Powder Div.

Vanadium-Alloys Steel Co.

Tin

American Metal Climax, Inc.

Belmont Smelting & Refining Works, Inc.

The Glidden Co.

Greenback Industries, Inc.

Charles Hardy, Inc.

Metal Atomizing & Processing Corp. Ltd.

Metals Disintegrating Co., Inc.

National Lead Co.

Zinc

Belmont Smelting & Refining Works, Inc.

Charles Hardy, Inc.

Metal Atomizing & Processing Corp. Ltd.

Metals Disintegrating Co., Inc.

New Jersey Zinc Co.

Miscellaneous Metals

Acheson Colloids Company
(graphite)

American Metal Climax, Inc.
(silver, solder)

4th in a series of POWDERED METAL PARTS applications by REESE

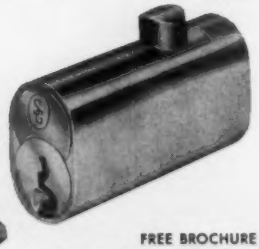
when SERVICE
and KNOW-HOW
count as much as
ECONOMY

3 Remet Powdered Metal Parts go into Sargent & Greenleaf

FILE CABINET LOCKS

(A) PLUG
(B) FILLER
(C) BOLT

According to Mr. George Paul, Chief Engineer, Sargent & Greenleaf, Inc., "A number of powdered metal parts producers were contacted to make these low cost, close tolerance, complex parts. Reese was the only one interested. We now find other practical applications and will, of course, use Reese as our prime source".



Formerly a zinc base die casting . . . now sintered brass for a higher melting point for use on insulated files.

FREE BROCHURE
"How to Cut Precision Parts Cost with the Remet Powdered Metal Process" shows how the Reese Corp. can help you. Send for your copy today.

Remet
REESE METAL PRODUCTS CORPORATION
537 Howard Ave., Lancaster 10, Penna.

Gears • Pinions • Cams • Ratchets
Oilless Bearings • Bushings • Machine and Structural Parts in
COPPER • BRASS • IRON • ALLOY STEEL • NICKEL SILVER • COPPER INFILTRATED IRON

Circle No. 62 on Reader Service Card

Metal Powders

One source for both Laboratory and production Quantities of all available metal powders, Aluminum to Zirconium.

Distributors For:

- NEW JERSEY ZINC BRASS
- UGINE COBALT
- VASCO PREALLOYED POWDERS
- WHITAKER COPPER

Charles Hardy Inc.

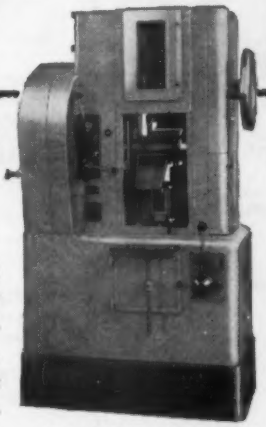
420 LEXINGTON AVE.,
NEW YORK 17, N.Y.

PHONE: LEXINGTON 2-4224

Circle No. 88 on Reader Service Card

HALLER...A Full Line Of Equipment For Press-Formed Parts

- CERAMICS
- CARBON
- PLASTICS
- POWDERED METAL
- FERRITES
- CARBIDES



MECHANICAL PRESSES
8 to 75 Tons

HYDRAULIC PRESSES
125 to 1,000 Tons

Illustrated is the 18-ton mechanical press widely used where extremely accurate fills are desired. Available with hydraulic pressure control for accurate densities in compacts.

Model 2000 (18 ton Cap.)

- **Furnaces for sintering powdered metals**
- **Kilns for ceramic and ferrite parts**

available in 2 standard continuous belt types and 1 pusher type, with generators for exo and endothermic gas as well as dissociators for hydrogen.

- **Laboratory specimen dies**
- **Tensile bars**
- **Bushings**
- **Transverse rupture specimens**

Illustrated is the standard 1" gage length tensile bar with 1" depth of fill.

Some 25 different shapes available. Designed to withstand pressures up to 100 t.s.i.

Variety of special shapes with interchangeability for maximum versatility.

- **Compression testing machines—4,000 lbs.**
- **Tensile testing machine—5,000 & 10,000 lbs.**
- **Powder blendors, cone and batch type**

Haller

HALLER Inc.

16580 NORTHVILLE ROAD • NORTHVILLE, MICH.

Write for detailed information

Circle No. 107 on Reader Service Card

The ONLY Sensible Solution for a Complicated Part

BRASS POWDER

SAVED 30¢ per piece!

By converting production of this meter movement support core from an investment casting to brass powder metallurgy*, Hickok Electrical Instrument Company

ELIMINATED
- EXCESSIVE MACHINING
- SCRAP LOSS
- INSPECTION TIME
- HIGH REJECTION RATE

GAINED
- DESIGN IMPROVEMENTS
- CLOSER TOLERANCES
- CORROSION RESISTANCE *(without plating)*
- LOWER PARTS COST

Brass powder metallurgy can produce accurate, low-cost components for *your* products as well. See a metal powder fabricator for details.

*by Engineered Plastics, Inc., Watertown, Conn.

IT'S NEW!

WRITE TODAY FOR YOUR FREE COPY.

THE NEW JERSEY ZINC COMPANY
160 Front Street, New York 38, N. Y.

Circle No. 56 on Reader Service Card

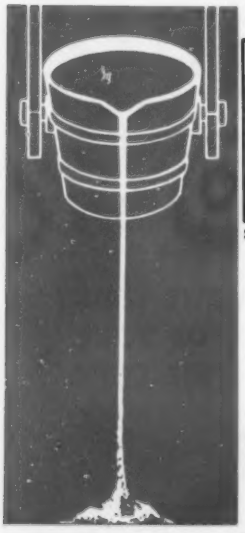
NOW

- *for easier fabrication*
- *better automation in parts handling*
- *longer die life*

HIGH GREEN STRENGTH

in **VASCO Prealloyed METAL POWDERS**

For example: compare the green properties presented below for our previous 304 and 316 stainless powders—with the same grades TODAY, achieved by continuing improvement in Vasco production techniques. Note that compacting conditions were *identical*.



		YESTERDAY		TODAY	
Vasco Type	Molding Pressure t.s.i.	Green Density gms/cc	Green Transverse Rupture p.s.i.	Green Density gms/cc	Green Transverse Rupture p.s.i.
304	30	5.15	800	5.85	2500
	40	5.50	1200	6.15	3600
	50	5.75	1800	6.35	4400
316	30	5.20	1200	6.00	2500
	40	5.65	2000	6.25	4000
	50	5.90	2700	6.50	5000

Standard MPIF Transverse Rupture Bars—Die Wall Lubrication Only.

Green strength of Vasco Prealloyed metal powders is now more than ample for intricate parts—with all the advantages of homogeneous alloy distribution. Let a Vasco sales engineer give you facts that can increase your sales potential now. Write without obligation.

Vanadium-Alloys Steel Company

POWDER METALLURGY DEPARTMENT

LATROBE, PENNSYLVANIA

Circle No. 71 on Reader Service Card

Brush Beryllium Company
(beryllium)

Plastic Metals Division
Crane Company
(manganese, silicon, iron-aluminum, iron-manganese)

Crucible Steel Co. of America
Spaulding Works
(hard facing powders, cobalt base alloys, nickel base alloys)

Fansteel Metallurgical Corporation
(tungsten, tantalum, molybdenum, columbium)

Foote Mineral Co.
(cobalt, zirconium)

General Electric Company
Lamp Metals & Components Dept.
(tungsten, molybdenum)

The Glidden Company
Chemicals-Pigments-Metals Division
(bronze)

Handy & Harman
(silver)

Charles Hardy, Inc.
(cobalt, molybdenum)

Hoeganaes Sponge Iron Corp.
(Iron and Cobalt base alloys)

Kulite Tungsten Company
(tungsten, cobalt, nickle, molybdenum, tungsten carbide)

Metal Atomizing & Processing Corp. Ltd.
(solder, bronze)

Metal Hydrides, Inc.
(zirconium, titanium, zirconium-nickel, titanium-nickel, chromium-nickel)

Metals Disintegrating Co.
(bronze)

Metals & Residues, Inc.
(tungsten, molybdenum, refractory metals)

National Lead Co.
(cobalt)

Powder Metals Research, Inc.
(tungsten, cobalt, nickel, molybdenum, tungsten carbide)

Sherritt Gordon Mines Ltd.
(cobalt)

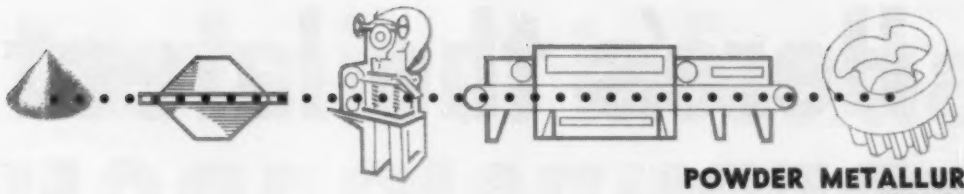
Southwestern Graphite Co.
(graphite)

Sylvania Electric Products, Inc.
Chemical & Metallurgical Division
(tungsten, molybdenum)

United International Research
(titanium, titanium alloys)

Vanadium-Alloys Steel Company
(Vasco 4600, specialty alloys on inquiry)

Vascoloy- Ramet Corporation
(tungsten, columbium, tantalum carbide, tungsten and titanium carbide)



NINTH ANNUAL

POWDER METALLURGY DIRECTORY

SECTION 2/ BUYERS GUIDE

COMPONENT FABRICATORS

Adamas Carbide Corp.
Kenilworth, N. J.

Allegheny Ludlum Steel Corp.
Oliver Bldg., Pittsburgh 22, Pa.

Allied Sinterings, Inc.
R.F.D. #2, Danbury, Conn.

American Powdered Metals, Inc.
7 Philip Pl., North Haven, Conn.

American Sinteel Corp.
A Sub. of Mueller Brass Co.
1019 Saw Mill River Rd., Yonkers, N. Y.

The Arnold Engineering Co.,
P.O. Box G, Marengo, Ill.

Arrow Sintered Products Co.
1900 S. Kostner Ave., Chicago 23, Ill.

Asco Sintering Corp.
7799 Telegraph Rd., Los Angeles 22, Calif.

The Bassick Co.
3045 Fairfield Ave., Bridgeport, Conn.

Bendix Aviation Corp.
Tabbits Ave., Green Island, N. Y.

Bound Brook Oil-Less Bearing Co.
Bound Brook, N. J.

Brockway Pressed Metals, Inc.
921 Clark, Brockway, Pa.

Bunting Brass & Bronze Co.
715 Spencer St., Toledo 1, Ohio

Burgess-Norton Mfg. Co.
737 Peyton St., Geneva, Ill.

Carbide, Inc.
27 Hillview Ave., Latrobe, Pa.

Carbon City Products Co., Inc.
Ford Rd., St. Marys, Pa.

Ceromet, Inc.
16233 Gale Ave., La Puente, Calif.

Chicago Powdered Metal Products Co.
9700 W. Waveland Ave., Schiller Park, Ill.

Chrysler Corp.
Amplex Div.
P.O. Box 2718, 6501 Harper Ave., Detroit 31, Mich.

Sintercast
Div. of Chromalloy Corp.
134 Woodworth Ave., Yonkers 2, N. Y.

Cleveland Graphite Bronze
Div. of Clevite Corp.
1700 St. Clair Ave., Cleveland 10, Ohio

Cleveland Powder Metals Co.
320 S. Water, Kent, Ohio

Clevite Ltd.
1177 Talbot St., St. Thomas, Ontario, Canada

Compacted Metals Corp.
99 Greenwood Ave., Waukegan, Ill.

Custom Components, Inc.
P.O. Box 248, Caldwell, N. J.

Detroit Aluminum & Brass Corp.
3975 Christopher Ave., Detroit, Mich.

Deva-Metal Div., S.K.C. Research Associates
445 Fifth Ave., Paterson 4, N. J.

Dixon Sintaloy, Inc.
535 Hope St., Stamford, Conn.

Eaton Mfg. Co.
Powdered Metals Div.
325 Jay St., Coldwater, Mich.

Elco Sintered Alloys Co., Inc.
1161 Brussells St., St. Marys, Pa.

Engelhard Industries, Inc.
Baker Contact Div.
207 Grant Ave., E. Newark, N. J.

Engineered Plastics, Inc.
American Sinterings Div.
P.O. Drawer P, Watertown, Conn.

Fansteel Metallurgical Corp.
N. Chicago, Ill.

Federal-Mogul-Bower Bearings, Inc.
11031 Shoemaker Ave., Detroit, Mich.

Ferro Powdered Metals, Inc.
Box 312, Salem, Ind.

Ferroxcube Corp. of America
Saugerties, N. Y.

Firth Sterling, Inc.
3113 Forbes Ave., Pittsburgh 30, Pa.

Ford Motor Co.
Rawsonville Plant
McKean & Textile Rd., Ypsilanti, Mich.

General Carbon Co.
315 N. Webster St., Naperville, Ill.

General Ceramics
Div. of Indiana General Corp.
21 Crows Mill Rd., Keasbey, N. J.

General Electric Co.
Metallurgical Products Dept.
11177 East Eight Mile Rd., Detroit 32, Michigan

General Metals Powder Co.
130 Elinor Ave., Akron 5, Ohio

Delco Moraine Div.
General Motors Corp.
1420 Wisconsin Blvd., Dayton 1, Ohio

General Sintering Corp.
3907 Wesley Terrace, Schiller Park, Ill.

Gibson Electric Co.
Box 547, Delmont, Pa.

Globe Industries, Inc.
Supermet Div.
1460 Cincinnati St., Dayton, Ohio

Haller, Inc.
16580 Northville Rd., Northville, Mich.

Handy & Harman
82 Fulton St., New York 38, N. Y.

Indar Corp.
2215 Alvord St., Indianapolis 5, Ind.

The Indiana Steel Products Co.
Div. of Indiana General Corp.
405 Elm St., Valparaiso, Ind.

International Powder Metallurgy Co.
439 W. Main St., Ridgway, Pa.

International Powder Metallurgy, Inc.
Rocky Mountain Metals Div., Inc.
3200 N. Century Ave., Colorado Springs, Colo.

Johnson Bronze Co.
500 S. Mill St., New Castle, Pa.

Kennametal, Inc.
Lloyd Ave., Latrobe, Pa.

Keystone Carbon Co.
State St., St. Marys, Pa.

Kulite Tungsten Co.
1040 Hoyt Ave., Ridgefield, N. J.

Kwikset Powdered Metal Products
Kwikset Division, American Hardware Corp.
516 E. Santa Ana St., Anaheim, Calif.

Link-Belt Co.
220 S. Belmont Ave., Indianapolis 6, Indiana

Lux Clock Mfg. Co.
95 Johnson St., Waterbury 20, Conn.

Magnetic Core Corp.
John & Lawrence Sts., Newburgh, N. Y.

Mallory Metallurgical Co.
Div. of P. R. Mallory & Co., Inc.
3029 E. Washington St., Indianapolis 6, Ind.

A. B. McMakan Co.
693 Raymond Ave., St. Paul, Minn.

Merriman Brothers, Inc.
187 Amory St., Jamaica Plain 30, Mass.

Metal Ceramics Powdered Metal Products
1511 Mannheim Rd., Melrose Park, Ill.

Metal Powder Products, Inc.
P.O. Box 189 P, Logan, Ohio

Here's the latest on REPUBLIC IRON

Republic offers you these helpful guides to Metal Powder Selection and Application—

Here, in clear, concise form, is newly revised and expanded background information you need in selecting the right metal powder to meet your design and fabricating requirements.

ADV. 1028—Properties of Republic HS6460 High Strength Powder. Includes detailed information on fatigue and impact testing. Traces the performance on HS6460, the powder developed by Republic to provide excellent carbon compatibility for higher stressed structural parts.

ADV. 1014—Technical Information on Republic Controlled Dimensional Factor Powders and MS Powder. Specially prepared data for part designers, tool engineers, metallurgists, and fabricators.

MAIL THE COUPON FOR YOUR FREE COPIES OF THESE VALUABLE BOOKS

technical information and ALLOY POWDERS

REPUBLIC METAL POWDERS GIVE YOU FULL RANGE COVERAGE

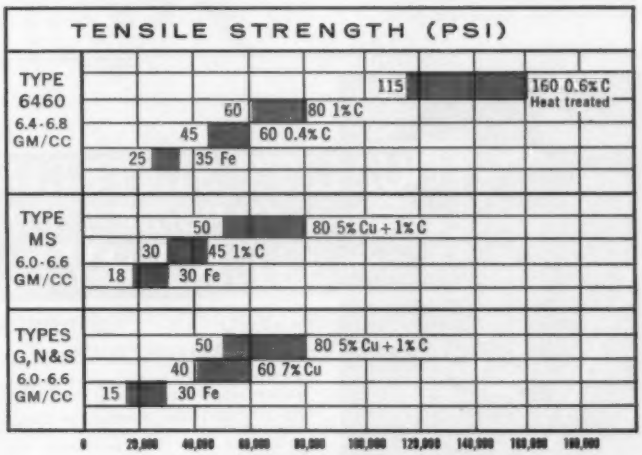
Republic's wide range of iron and alloy powders covers all known physical property requirements of metal powder part fabricators.

HS6460 ALLOY POWDER

This soft, alloy powder offers excellent compressibilty and makes possible higher tensile strengths than ever before achieved with ferrous powders. HS6460 is capable of providing a minimum tensile strength of 60,000 psi at 6.4 density as sintered—100,000 psi after heat treatment. Excellent carbon compatibility enhances its ability to be heat treated. HS6460 is ideally suited for use in all major applications of ferrous powder metallurgy. It can be used for comparable strength structural parts at lower manufacturing costs than obtainable with copper infiltration when used at a 6.4 density and higher.

MS IRON POWDER

This is a very soft reduced material that was developed principally for use with graphite rather than copper. It possesses features which make it economically attractive. Strength with 1% graphite after sintering is comparable to the strength of compacts made with 7 to 10% copper and sintered. Thus, it can be used for comparable strength structural parts at less cost than obtainable with copper. MS displays excellent carbon compatibility. Responds exceedingly well to heat treatment. Its purity and compressibility suit MS for some electronic core applications as well as other electrical and magnetic applications.



CDF IRON POWDERS

The three grades of powder in this classification each have a distinct dimensional change characteristic when used in copper blends. This characteristic is called *Controlled Dimensional Factor.* Type "G" has a definite growth characteristic in the presence of copper and has been developed for use in dies designed to use powder which expands when sintered. Type "N" provides for normal variation in dimensional change from a slight shrinkage to a slight growth. Type "S" offers extremely high shrinkage values.

VISIT US AT THE POWDER METALLURGY SHOW, BOOTHS 27 AND 28, DRAKE HOTEL, CHICAGO, APRIL 25-27.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. PM-9269
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send me a FREE copy of:

☐ ADV. 1028—Properties of HS6460 Alloy Powder
☐ ADV. 1014—Technical Information on CDF and MS Powders

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Circle No. 63 on Reader Service Card

ECONOMY and PRECISION in POWDERED METAL PARTS by NORWALK

QUALITY CONTROL from blueprint to finished machine part. Specified strengths and tolerances are maintained from the first part to the millionth.

ECONOMY. Mass production brings the unit cost down for important savings.

SERVICE. Whether delivery requirements are routine or "emergency," we have the flexibility to meet your schedules.

DESIGN. Our Design Engineers employ powdered metallurgy at its maximum potential to produce precision parts that do the job . . . with important economies in fabrication.

Submit your metal parts problems to us for study and suggestions *without obligation.*

FREE

Write for information folder, "Converting Powdered Metal into Machine Parts".

NORWALK POWDERED METALS INC.

8 Muller Park, Norwalk, Conn.

Circle No. 57 on Reader Service Card

Micro Metallic Corp.
30 Sea Cliff Ave., Glen Cove, N. Y.

Micrometals
72 E. Montecito Ave., Sierra Madre, Calif.

Midwest Sintered Products Corp.
13605 So. Halsted St., Chicago 27, Ill.

National Molded Products, Inc.
40-42 S. St. Marys St., St. Marys, Pa.

National Moldite Co.
250 So. Street, Newark, N. J.

Neosid (Canada) Ltd.
10 Vansco Rd., Toronto 18, Ontario, Can.

Norwalk Powdered Metals, Inc.
Muller Park, Norwalk, Conn.

Pacific Sintered Metals Co.
633 Isis Ave., Inglewood 1, Calif.

Parker White-Metal Co.
2153 McKinley Ave., Erie, Pa.

Perth Metal Industries Ltd.
P.O. Box 154, 128 Monteith Ave.,
Stratford, Ontario, Can.

Picco, Inc.
1729 N. Chico Ave., El Monte, Calif.

Powder Alloys Corp.
316 Colfax Ave., Clifton, N. J.

Powder Metals Research, Inc.
1036 Hoyt Ave., Ridgefield, N. J.

Powdercraft Corp.
746 Hayne St., Spartanburg, S. C.

Precision Metal Products Co.
P.O. Box 129, Ellwood City, Pa.

The Presmet Corp.
112 Harding St., Worcester, Mass.

Pyroferric Co., Inc.
621 E. 216th St., New York 67, N. Y.

Raybestos-Manhattan, Inc.
Manhattan Rubber Div.
61 Willett St., Passaic, N. J.

Raybestos Manhattan, Inc.
Wabash Div.
Crawfordsville, Ind.

Reese Metal Products Corp.
537 Howard Ave., Lancaster, Pa.

Remington Arms Co., Inc.
Hoefler Ave., Ilion, N. Y.

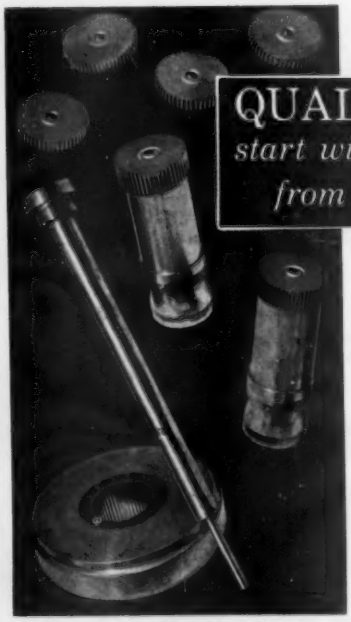
Romanoff Machine & Tool Co.
769 Southbridge St., Worcester, Mass.

St. Marys Carbon Co.
State St., St. Marys, Pa.

Sintered Metals, Inc.
3400 Washington St., Boston 30, Mass.

A. O. Smith Corp.
Crowley Div.
1 Central Ave., W. Orange, N. J.

Stackpole Carbon Co.
1942 Tannery Rd., St. Marys, Pa.



QUALITY SINTERINGS *start with CARBIDE TOOLING from* GENTRY . . . .

YOU TOO CAN BENEFIT FROM GENTRY'S

EXPERIENCE: 22 Years of Tool and Die experience — 10 years in the Carbide field.

ENGINEERING: Special re-designing so that Carbide can replace your present tools and dies. Our engineers will assist you or do complete conversion.

FACILITIES: We are noted for maintaining the latest models of modern machinery and equipment for manufacturing the highest quality of tools and dies. Our most recent addition is a Cincinnati Elektro Jet.

QUALITY-GUARANTEE: All Gentry dies are guaranteed to be high quality, best workmanship, long wearing.

Write today for our brochure listing our facilities and qualifications.

We specialize in these carbide products:
Component parts for powdered metal presses:
Form Rolls • Draw Dies • Swaging Dies
• Blanking Dies • Jigs & Fixtures •

GENTRY *CARBIDE TOOL & DIE CO., INC.*

127 Main St. • Beech Grove, Ind. • Phone: ST 7-2228.

Circle No. 33 on Reader Service Card

HOEGANAES

Pre-Alloyed Powders offer you 4-star performance

★★★★ Due to their high purity, Hoeganaes Pre-Alloyed Powders can be processed with the same ease as ordinary iron powders.

★★★★ They offer excellent compressibility and high green strength.

★★★★ HSIC Pre-Alloyed Powders can be sintered at low temperatures (approximately 2050° F.) for short periods of time. Of course, they must be sintered in dry atmospheres.

★★★★ Dissociated ammonia has been found to be satisfactory for most applications . . . and if dewpoint is a problem, ordinary covering has given quite adequate results.

Best of all, you'll find that your nearby HSIC service engineer can and will work with you to the end of trouble free production. Your problems become his problems until production success is assured. You'll find he's a good man to know—why not get to know him today?

. . . and when it comes to iron powders selection, be sure to specify HOEGANAES

Here's the master check list of iron powders—Hoeganaes offers a complete line of metal powders that give you the properties you want, for the metal parts properties you want to produce.

Ancor MH-100
Known throughout the powder metallurgy industry as the "work horse" of the industry. Famous as the world wide standard for uniformity, compressibility, iron carbon parts production and copper infiltration.

Ancor MH-100-S
Equally famous for the properties above, plus improved compressibility and purity. The right powder for production of large parts or higher density parts.

Ancor 80
On down the years, Ancor 80 is still the outstanding choice for green and sintered strength.

Ancor EP-1024
The popular choice for maximum purity and best compressibility.

Ancor MC Magnatite Powders
The powder of extreme purity—available in a wide range of sizes.

Ancor MH-300-P
Highest possible purity in —300 mesh size.

Ancor Flake Iron Powders
A complete line available in various sizes.

HSIC

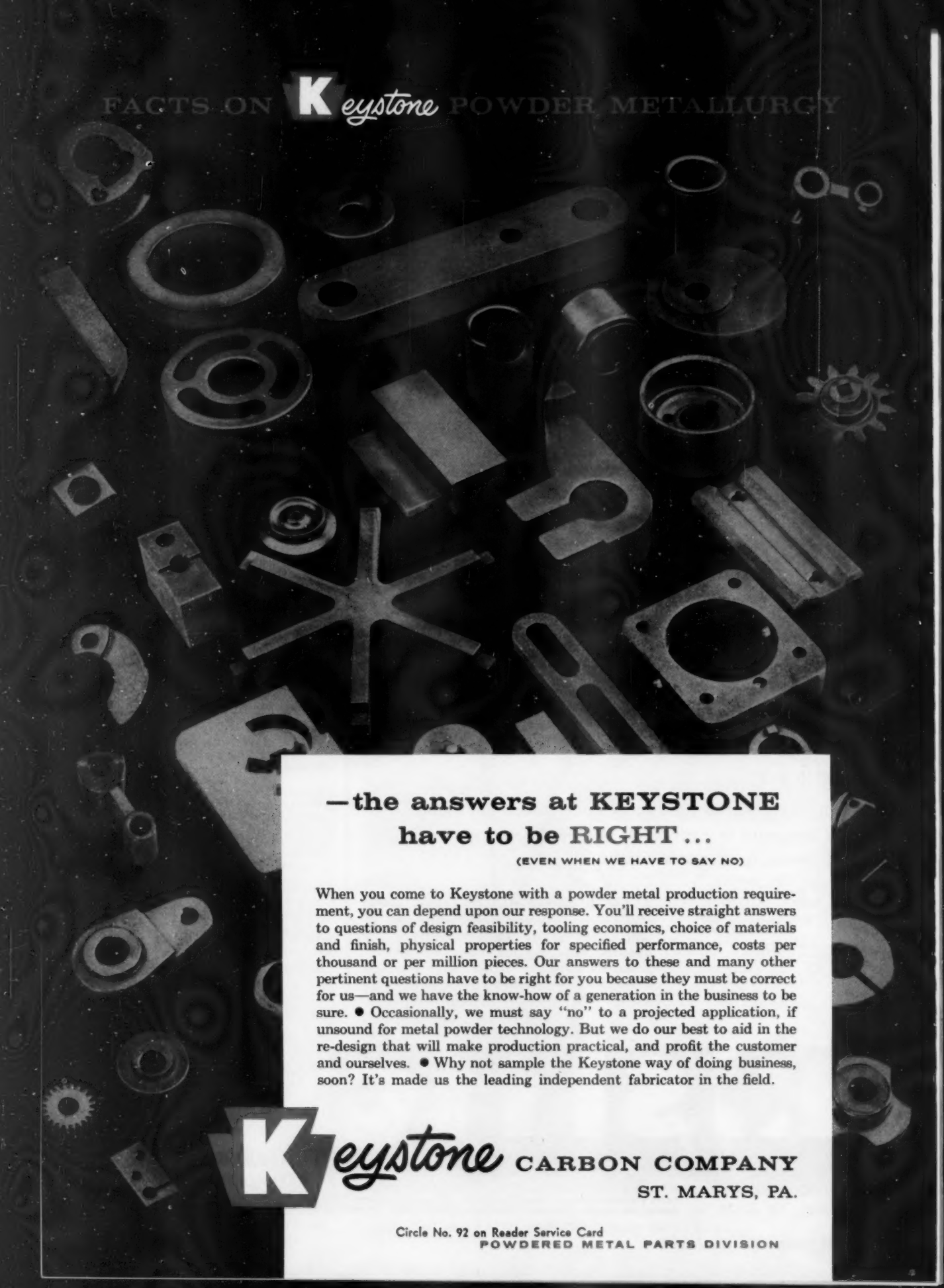
HOEGANAES

HOEGANAES SPONGE IRON CORPORATION

RIVERTON, NEW JERSEY

SALES REPRESENTATIVES IN PRINCIPAL CITIES: Birmingham, Chicago, Cincinnati, Cleveland (Fostoria), Edmonton (Alberta, Canada), Los Angeles, Minneapolis, New England (Elmira, N.Y.), Philadelphia (Riverton, N. J.), Pittsburgh, San Francisco, St. Louis

Circle No. 39 on Reader Service Card



—the answers at KEYSTONE have to be RIGHT...

(EVEN WHEN WE HAVE TO SAY NO)

When you come to Keystone with a powder metal production requirement, you can depend upon our response. You'll receive straight answers to questions of design feasibility, tooling economics, choice of materials and finish, physical properties for specified performance, costs per thousand or per million pieces. Our answers to these and many other pertinent questions have to be right for you because they must be correct for us—and we have the know-how of a generation in the business to be sure. ● Occasionally, we must say "no" to a projected application, if unsound for metal powder technology. But we do our best to aid in the re-design that will make production practical, and profit the customer and ourselves. ● Why not sample the Keystone way of doing business, soon? It's made us the leading independent fabricator in the field.

Keystone CARBON COMPANY
ST. MARYS, PA.

Circle No. 92 on Reader Service Card
POWDERED METAL PARTS DIVISION

Standard Carbon Co.
P.O. Box 49, Wintersville, Ohio

Sterling Engineering Corp.
Box 559, Winsted, Conn.

Superior Carbon Products, Inc.
9115 George Ave., Cleveland 5, Ohio

Symmco, Inc.
P. O. Box F, Sykesville, Pa.

Technametals, Inc.
R.D. #1 Box 48, Johnson Rd., Pitcairn, Pa.

United States Graphite Co.
Div. of The Wickes Corp.
Saginaw, Mich.

Valenite Metals
Div. Valeron Corp.
Box 205, Royal Oak, Mich.

Vascoloy-Ramet Corporation
800 Market St., Waukegan, Illinois

Wakefield Bearing Corp.
29 Foundry St., Wakefield, Mass.

The S. K. Wellman Co.
200 Egbert Rd., Bedford, Ohio

Western Sintering Co.
1419 Potter Ave., Richland, Wash.

EQUIPMENT

Acheson Colloids Co.
1635 Washington Ave., Port Huron, Mich.

Circle No. 99 on Reader Service Card

BUILD A BETTER PRODUCT, MAINTAIN QUALITY, CUT COSTS.....
USE
MERRIMAN
POWDERED METAL PARTS

PRECISION MADE —
HIGHEST QUALITY —
DIMENSIONALLY PERFECT

Merriman, originators of sintered helical gears, offer high density, precision structural parts from powdered metal in Brass, Bronze, Copper, Nickle Silver, Steel, Iron and Iron Alloys. Complete design and engineering service available.

WRITE FOR CATALOG AND COMPLETE INFORMATION.

POWDERED METAL DIVISION
MERRIMAN BROS., INC.
ORIGINATORS OF SINTERED HELICAL GEARS
185 Amory Street, Boston 30, Mass.

REPRESENTATIVES IN PRINCIPAL CITIES
183 So. Chatsworth — 301, St. Paul, Minn. | 793 Laureiton Rd., Rochester 9, N.Y. | 26018 West Seven Mile Rd., Detroit 19, Mich.

METAL POWDER PARTS
HIGH-DENSITY

carburized steel properties in unusual shapes

Supermet specializes in metal powder parts requiring extreme physical properties and/or unusual intricacy. Controlled carburized case plus new approaches to die design bring you steel parts with the economy of powder metallurgy. As an indication of capability, a case hardened counter pinion* is currently produced with tooth extensions which withstand a 60 lb. load; not a single reject in half a million parts—tangible savings are 25%.
Send your part print today.

*three times actual size

GLOBE

SUPERMET DIVISION
GLOBE INDUSTRIES, INC.
1467 Cincinnati St.
Dayton 8, Ohio
free technical literature

Circle No. 95 on Reader Service Card

COLUMBIA
TOOL
STEELS

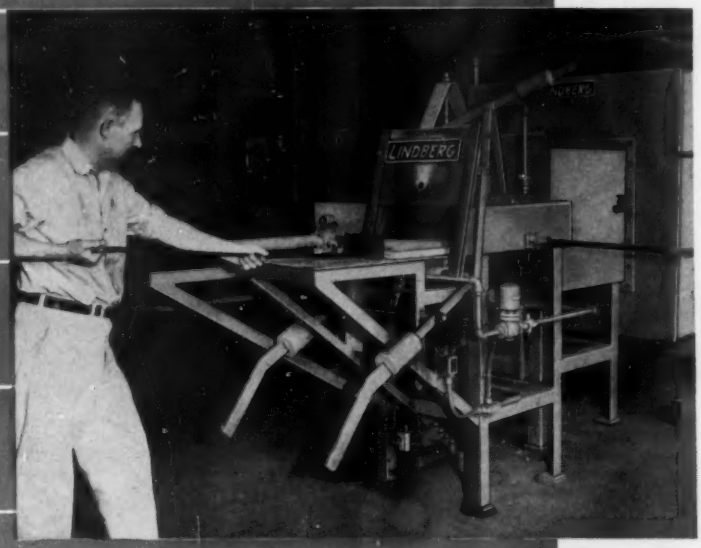
Confidentially, people who *make money* with die casting and extruding dies use ALCODIE (Type H12) hot work steel

Product of Skilled American Workmen

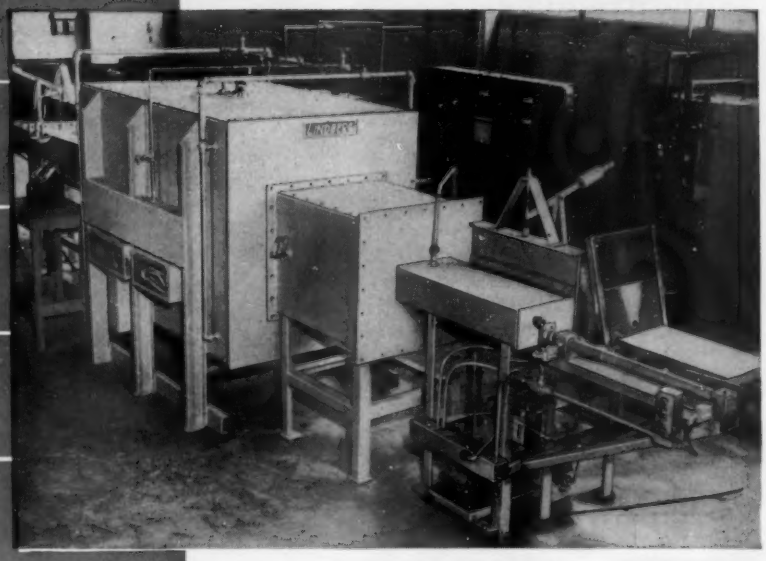
COLUMBIA TOOL STEEL COMPANY
460 Lincoln Highway
Chicago Heights, Illinois

NEW LINDBERG FURNACE PROVIDES IMPROVED EFFICIENCY FOR STAINLESS STEEL SINTERING

This Molybdenum Element Atmosphere Pusher Type Furnace embodies high temperature refractories suitable for low dew point without muffle



This new furnace provides an improved method for sintering stainless steel compacts in hydrogen or dissociated ammonia. A development of Lindberg's engineering staff, you can depend on the most efficient, economical and trouble-free service from it. Furnace provides side loading and discharge parts with purging chambers. Work trays, ceramic slabs or molybdenum boats, move through the furnace by hydraulic pusher. In the installation illustrated below ammonia dissociator and control panels are shown at the right. Hydrogen supply cylinders are located outside the building. For full information on this and Lindberg's complete line of sintering and brazing furnaces just get in touch with your local Lindberg Field Representative (see classified phone book) or write us direct. Lindberg Engineering Company, 2463 West Hubbard Street, Chicago 12, Illinois.



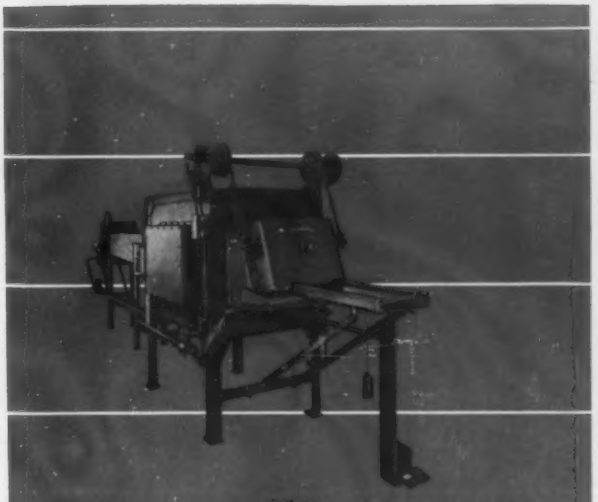
Type MOP-12367-A80C Molybdenum Element Atmosphere Pusher Furnace. Maximum Temperature 3000° F. 60 KW input. 12" wide, 30" long, 7" high. 60" cooling chamber, 36" long preheat chamber.

LINDBERG heat for industry

As it does in all types of industrial heating equipment, Lindberg provides a complete line of sintering and brazing furnaces. For example:

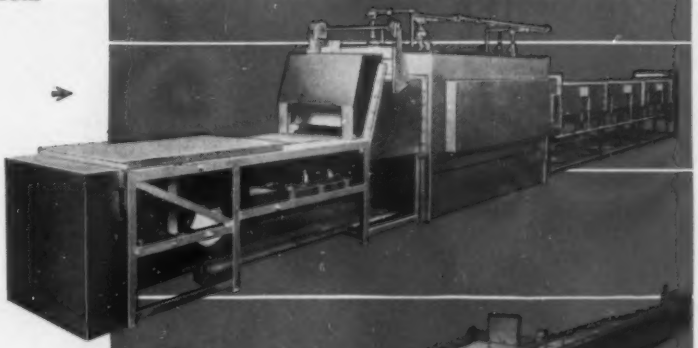
This Hand Pusher Batch Type Furnace →

is used for small production lots and experimental sintering. It is an all-purpose unit for operation from 1300°F to 2500°F. Made in various sizes for sintering from 25 to 300 pounds per hour.



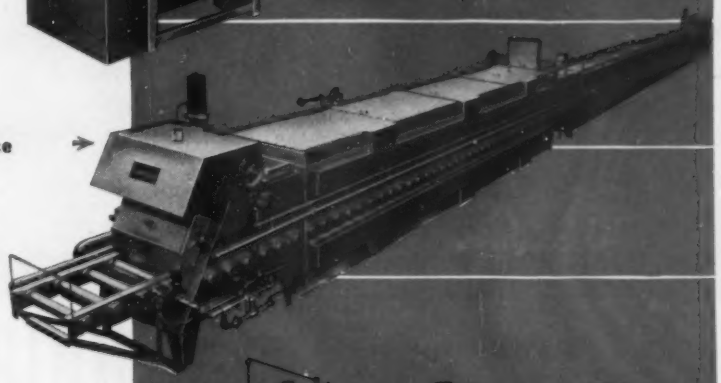
This Mesh Belt Continuous Type Furnace →

is a popular sintering furnace for small light parts in copper, bronze, brass or steel with a temperature range from 1300°F. to 2100°F. It can be used for low temperature silver brazing, bright annealing, as well as sintering of powder metals. Production ranges up to 500 pounds per hour.



This Roller Hearth Continuous Type Furnace →

is especially designed to handle heavier loads up to 2200 pounds per hour. It has an effective temperature range from 1300°F. to 2100°F. It can be used for bright annealing, low temperature silver brazing as well as sintering of powder metals.



Atmosphere Generators →

To obtain the best work from any sintering furnaces, the proper atmosphere is required. The atmosphere generators described here provide the proper atmospheres recommended for use with Lindberg Sintering Furnaces.

1. The HYEX Generator produces atmosphere composed of approximately 4% carbon dioxide—18% hydrogen—12% carbon monoxide and 66% nitrogen.

2. The HYEN Generator produces a neutral atmosphere composed of approximately 21% carbon monoxide—40% hydrogen—38% nitrogen and 1% methane.

3. The HYAM Generator produces atmosphere composed of approximately 75% hydrogen and 25% nitrogen.

If you have a sintering or brazing problem why not talk it over with Lindberg. Just get in touch with your nearest Lindberg Field Representative or write us direct.

LINDBERG
ENGINEERING COMPANY
2463 West Hubbard Street, Chicago 12, Illinois
Los Angeles Plant: 11937 S. Regentview Ave., at Downey, Cal.
In Canada: Birlefco-Lindberg, Ltd., Toronto

Circle No. 102 on Reader Service Card

Adamas Carbide Corporation
Kenilworth, N. J.

Allegheny Ludlum Steel Corp.
20th Floor Oliver Bldg., Pittsburgh 22, Pa.

Allied Chemical & Dye Corp.
Barrett Div.
42 Rector St., New York, N. Y.

American Cyanamid Co.
30 Rockefeller Plaza, New York 20, N. Y.

American Metaseal Corp.
607 65th St., West N. Y., N. J.

American Oil & Supply Co.
238-260 Wilson Ave., Newark, N. J.

American Steel Foundries
Elmes Eng. Div.
1150 Tennessee Ave., Cincinnati 29, Ohio

Armour Industrial Chemical Co.
Div. of Armour & Co.
110 North Wacker Drive
Chicago 6, Ill.

Arnhold Ceramics, Inc.
Dorst Div.
One East 57th St., New York 22, N. Y.

B.I.P. Engineering Ltd.
Ralph B. Symons Associates, Inc.
3569 Main Road, Tiverton, R. I.

Baker Perkins, Inc.
1000 Hess St., Saginaw, Mich.

HOME of Quality Metal Powders

ALUMINUM
BRASS, LEADED BRASS
COPPER POWDER—GRAIN and FLAKE
NICKEL SILVER
INFILTRATING POWDERS
★
SPECIAL LOW DENSITY
HIGH GREEN STRENGTH
COPPER & BRASS
POWDERS

Composition and mesh to meet specific requirements. Selection range offering powders to match the part.

U. S. BRONZE POWDER WORKS, INC.

Flemington, N.J. • **Phone: STate 2-5454**

Circle No. 70 on Reader Service Card

Baldwin-Lima-Hamilton Corp.
Industrial Equipment Division
Philadelphia 42, Pa.

Barber-Colman Co.
Wheelco Instruments Div.
1300 Rock St., Rockford, Ill.

E. W. Bliss Co.
1375 Raff Rd., S.W., Canton 10, Ohio

Henry Bower Chemical Mfg. Co.
Gray's Ferry Rd. & 29th St., Phila., Pa.

Capital City Products Co.
525 W. First Ave., Columbus, Ohio

Capitol Products Corp.
Read Standard Div.
Richland Ave., York, Pa.

Champion Tool & Die Co.
Coulter Rd., P.O. Box 415, McKeesport, Pa.

Chromalloy Corp.
Sintercast Div.
134 Woodworth Ave., Yonkers, N. Y.

Cleveland Tool & Die Co.
30510 Lakeland Blvd., Willowick, Ohio

Clifton Hydraulic Press Co.
287-293 Alwood Rd. (P.O. Box 325)
Clifton, N. J.

Arthur Colton Co.
3400 E. Lafayette Ave., Detroit 7, Mich.

Continental-Industrial Engineers
901 N. Oak Park Ave., Oak Park, Ill.

Curd Enterprizes, Inc.
Multiplastics Div.
330-40 Factory Rd., Addison, Ill.

J. H. Day Co.
Div. of Cleveland Automatic Machine Co.
4932 Beech St., Cincinnati, Ohio

Diecraft Tool Co.
1275 Thomaston Ave., Waterbury 14, Conn.

Joseph Dixon Crucible Co.
167 Wayne Street
Jersey City 3, N. J.

The Drever Co.
Red Lion Rd. & Philmont Ave., Bethayres, Pa.

E. I. Du Pont de Nemours & Co.
Polychemicals Div.
Wilmington, Del.

R. A. Ekstrom Co.
15555 Millard Ave., Markham, Ill.

The Electric Furnace Co.
W. Wilson St., Salem, Ohio

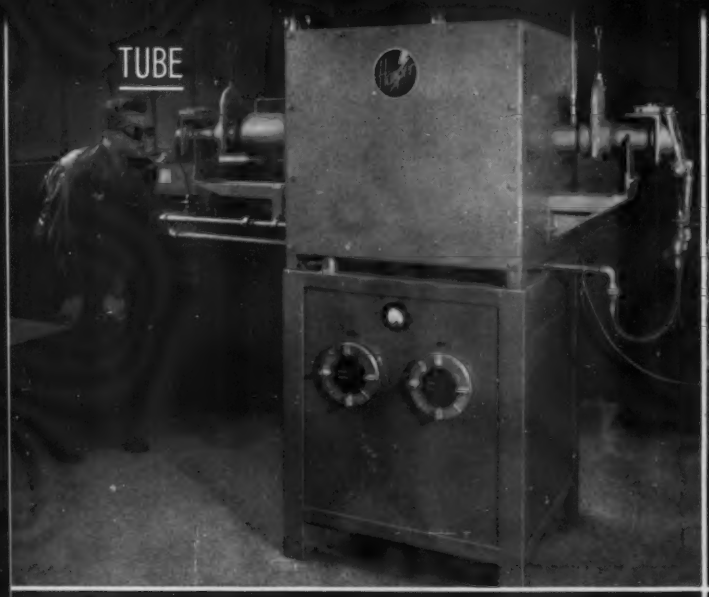
Elizabeth Carbide & Die Co., Inc.
5423 Smithfield St., McKeesport, Pa.

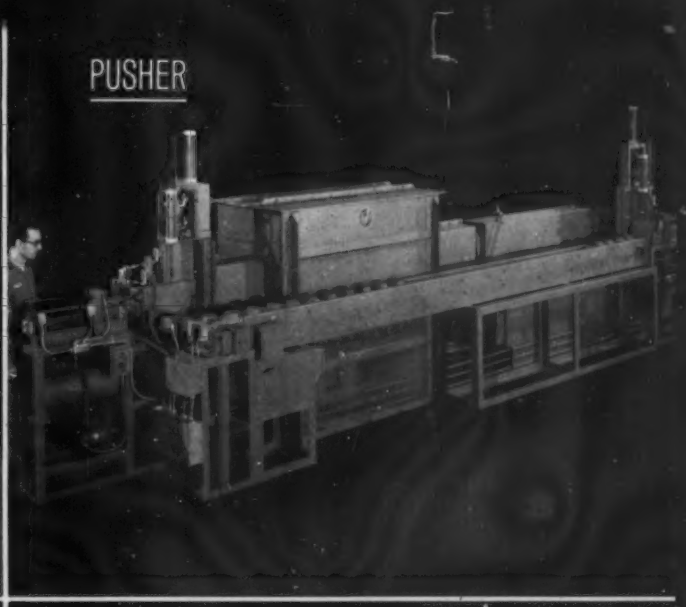
The Exolon Co.
1000 E. Niagara St., Tonawanda, N. Y.

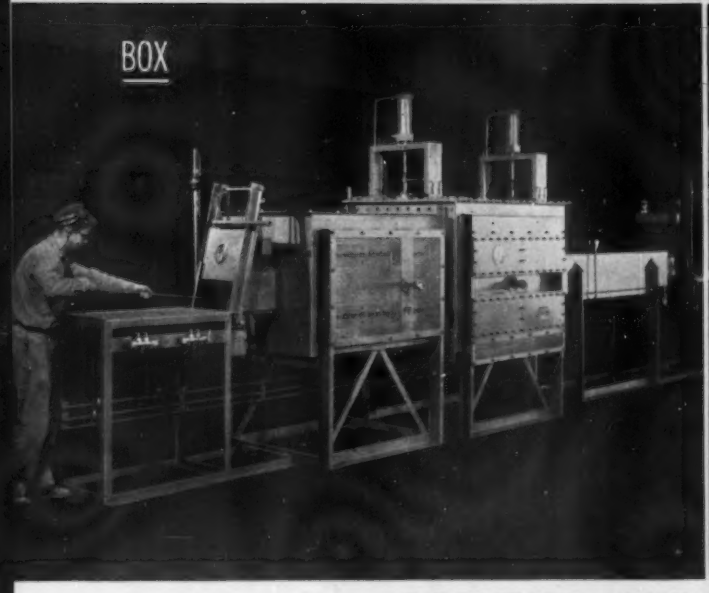
Falcon Equipment Co.
P. O. Box 255-P, New Brighton, Pa.

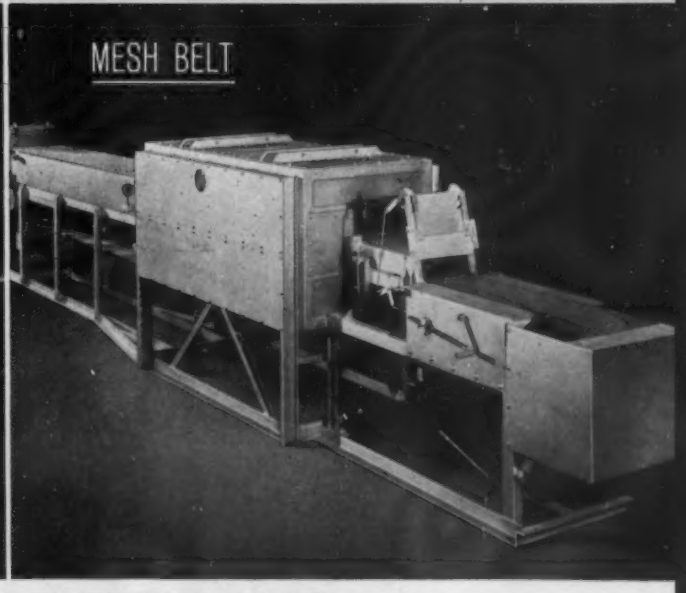
Ferguson Equipment Corp.
221 Corliss St., Pittsburgh 20, Pa.

Firth Sterling, Inc.
3113 Forbes Ave., Pittsburgh 30, Pa.









SINTERING FURNACES

all types to answer your powder metallurgy needs to best advantage

HARPER BUILDS THEM ALL: Box, pusher, mesh belt, roller hearth, bell, elevator and pit . . . for research, pilot plant and full scale production.

JUST NAME IT! No matter what the powdered metal — copper, brass, bronze, iron, iron graphite, tungsten or one of the stainless steels — Harper can supply the furnace that will do the sintering job most profitably for you. Furnished for manual and automatic operation, Harper electric furnaces are equipped with molybdenum, silicon carbide and nickel chromium alloy heating elements, as well as the proper refractories and controls, to match a diversified range of temperature and atmosphere requirements.

TAKE ADVANTAGE OF HARPER EXPERIENCE: The next time you are considering the addition or replacement of a sintering furnace, you'll find it pays to put it up to Harper early in the game — for Harper has the background to assist you in your planning. In the meantime, for more detailed information, write: Harper Electric Furnace Corp., 41 River St., Buffalo 2, N. Y.

HARPER ELECTRIC FURNACES

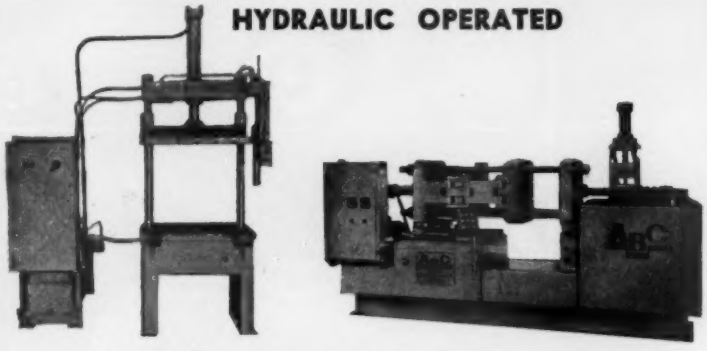
FOR BRAZING, SINTERING, WIRE ANNEALING, BRIGHT ANNEALING, FORGING AND RESEARCH

Circle No. 36 on Reader Service Card

Circle No. 1 on Reader Service Card

AIR OPERATED

HYDRAULIC OPERATED



Catalog available upon request

ABC DIE CASTING MACHINE COMPANY

400 East 142nd Street Dolton, Illinois

Foote Mineral Co.
18 W Chelten Ave., Phila., Pa.

The Gas Machinery Co.
16100 Waterloo Rd., Cleveland 10, Ohio

General Electric Co.
Metallurgical Products Dept.
11177 East Eight Mile Rd., Detroit 32, Mich.

General Electric Co.
Apparatus Sales Div.
1 River Rd., Schenectady 5, N. Y.

Gentry Carbide Tool & Die Co., Inc.
127 Main St., Beech Grove, Ind.

Claud S. Gordon Co.
3000 S. Wallace St., Chicago 16, Ill.

Haller, Inc.
16580 Northville Rd., Northville, Mich.

Hamler Industries, Inc.
6025 W. 66th St., Chicago, Ill.

Hannifin Co.
Div. of Parker-Hannifin Corp.
501 S. Wolf Rd., Des Plaines, Ill.

Harper Electric Furnace Corp.
110 Pearl St., Buffalo 2, N. Y.

C. I. Hayes, Inc.
878 Wellington Ave., Cranston 10, R. I.

Hevi-Duty Electric Co.
2040 W. Wisconsin Ave., Milwaukee, Wis.

LITTLE GEARS

YOUR GEARS ?

HARD BRONZE Industry demanded it and we developed it. Here are some of the features of our unique Grade HB-917 Hard Bronze. 32,000 p.s.i. tensile strength —B-75-80 Rockwell hardness, but retains a porosity of 20% by volume. It can be tapped, machined, ground, soldered, welded, staked and peened.

We can produce the gear you need. But we handle more than gears, of course. If your part demands a special alloy or closely controlled metal composition, porosity and tolerance, it will pay you to send a blueprint for our quotation. And remember, powdered metal parts eliminate your machining operations and scrap.

Send for FREE Guide to Designing for Powdered Metals.

IPM

INTERNATIONAL POWDER METALLURGY CO.

439 W. MAIN STREET • RIDGWAY, PENNSYLVANIA

Circle No. 104 on Reader Service Card

PRECISION METAL MOLDING

WITH AMCO ELECTROLYTICALLY PRODUCED COPPER POWDER, you obtain identical sinterings time after time because of its shipment to shipment uniformity. Quality control—from careful selection of electrolytically refined anodes . . . through electrolytic deposition . . . to contamination-free packaging—assures uniformity of AMCO Electrolytic Powder. Production techniques developed through *AMCO's 30 years experience in powder metallurgy* result in metal powders that are *characteristics-controlled* for economical, high-volume production of metal powder parts.

AMCO DIVISION *American Metal Climax, Inc.*
1270 Avenue of the Americas, Rockefeller Center, N. Y. 20, N. Y.

Other AMCO metal powders include copper alloy, tin, solder, and silver.

Circle No. 8 on Reader Service Card

Holcroft & Co.
6545 Epworth Blvd., Detroit 10, Mich.

Illinois Testing Laboratories, Inc.
420 N. LaSalle St., Chicago 10, Ill.

Imprex, Inc.
2023 S. 60th St., Milwaukee 19, Wisc.

International Engineering, Inc.
P.O. Box 973, Far Hills Branch,
Dayton 19, Ohio

International Sales Management Co.
Fawcett Div.
123 N. Poplar St., Charlotte 2, N. C.

A. Johnson & Co., Inc.
21 W. Street, New York 6, N. Y.

Johnson Machine & Press Corp.
620 W. Indiana Ave., Elkhart, Ind.

The C. M. Kemp Mfg. Co.
405 E. Oliver St., Baltimore 2, Md.

Kennametal, Inc.
Lloyd Ave., Latrobe, Pa.

Kux Machine Co.
6725 N. Ridge Ave., Chicago 26, Ill.

Leeds & Northrup Co.
4970 Stenton Ave., Philadelphia 44, Pa.

Lindberg Engineering Co.
2450 W. Hubbard St., Chicago 12, Ill.

Loomis Engineering & Mfg. Co.
#22 Route 46, Caldwell, N. J.

M & N Modern Hydraulic Press Co.
P.O. Box 504, 780 Rt. #3, Clifton, N. J.

Major Gauge & Tool Co.
26817 W. 7 Mile Rd., Detroit 40, Mich.

Mannesmann-Meer, Inc.
900 Line St., Easton, Pa.

Mercer-Robinson Co., Inc.
395 Allwood Rd., Clifton, N. J.

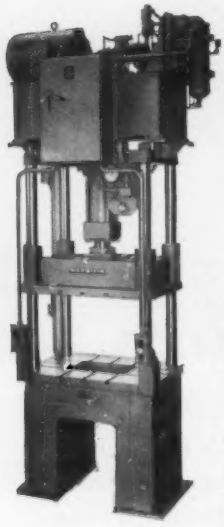
Metals Disintegrating Co., Inc.
P. O. Box 290, Elizabeth "B", N. J.

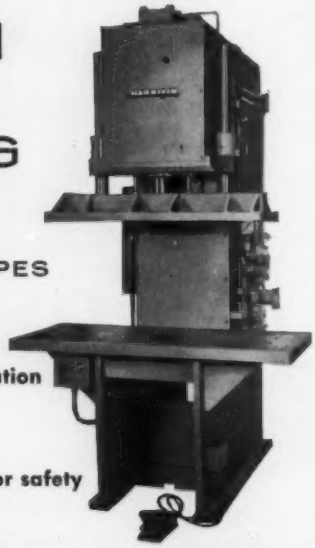
Get more parts per hour with

HANNIFIN

HYDRAULIC DIE TRIMMING PRESSES

OPEN GAP OR COLUMN TYPES





- **High speed operation**
- **Easier set-up**
- **Longer die life**
- **Complete operator safety**
- **2 to 150 tons**

Faster Speeds • Lower Prices • Quick Delivery

YOU GET THESE FEATURES:

1. Safe, dual electric (or hand) controls
2. Automatic reverse on pressure or distance (adjustable)
3. Adjustable ram pressure
4. Extra-large tables standard
5. All-steel welded and stress-relieved construction
6. Hardened and chrome-plated rams and guide rods

For the full story of the advantages of high speed hydraulic trimming, send for our Bulletin 142. Or call in your Hannifin representative—he's a trained production analyst.

HANNIFIN COMPANY
581 South Wolf Road • Des Plaines, Illinois

A DIVISION OF PARKER-HANNIFIN CORPORATION
Circle No. 59 on Reader Service Card

Micro-Carbide Tool & Die Co., Inc.
431 N. Holmes, P.O. Box 22187,
Indianapolis 22, Ind.

Midland Ammonia Co.
Midland, Mich.

Surface Combustion
Div. of Midland-Ross Corp.
2375 Dorr St., Toledo 1, Ohio

Minneapolis-Honeywell Regulator Co.
Brown Instruments Div.
Wayne & Windrim Aves., Phila. 44, Pa.

The Minster Machine Co.
Fifth at Canal, Minster, Ohio

Monarch Tool & Gauge Co.
15778 Telegraph Rd., Detroit 39, Mich.

Monsanto Chemical Co.
Inorganic Chemicals Div.
800 N. Lindbergh Blvd., St. Louis, Mo.

National Carbide Die Co.
Greenock Rd., McKeesport, Pa.

Nopco Chemical Co.
Metasap Div.
60 Park Pl., Newark 1, N. J.

Olin Mathieson Chemical Corp.
Chemicals Div.
Mathieson Bldg., Baltimore, Md.

M. W. Parsons-Plymouth, Inc.
59 Beekman St., New York, N. Y.

Pereny Equipment Co.
893 Chambers Rd., Columbus 12, Ohio

Posey Iron Works, Inc.
Industrial Heating Div.
Lancaster, Pa.

The Pyrometer Instrument Co., Inc.
92 Portland Ave., Bergenfield, N. J.

Read Standard Corp.
York, Pa.

Arklay S. Richards Co., Inc.
119 Winchester St., Newton Highlands 61,
Mass.

Sargeant & Wilbur, Inc.
180 Weeden St., Pawtucket, R. I.

The Sentry Co.
62 Main St., Foxboro, Mass.

Service Associated, Inc.
9236 S. Vincennes Ave., Chicago 20, Ill.

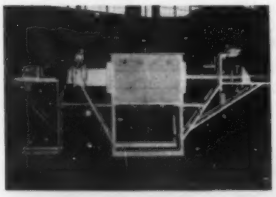
John E. Skach Tool Co.
1523 Mannheim Rd., Stone Park, Ill.

F. J. Stokes Corp.
5500 Tabor Rd., Philadelphia 20, Pa.

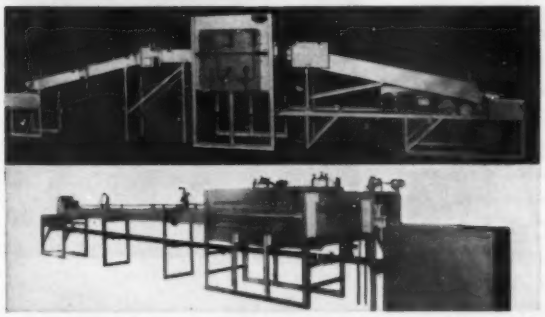
Sturtevant Mill Co.
103 Clayton St., Boston 22, Mass.

Sunbeam Corp.
Industrial Furnace Div.
4433 W. Ogden Ave., Chicago 23, Ill.

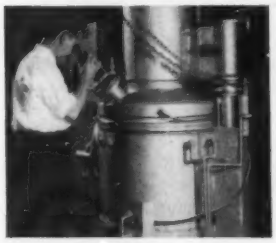
Sunbeam Equipment Corp.
180 Mercer St., Meadville, Pa.



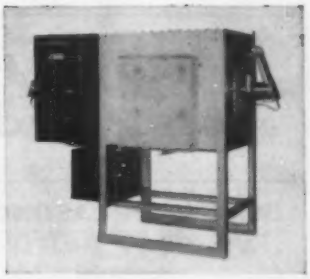
HAYES TYPE M-Y HIGH-TEMPERATURE FURNACES . . . provide uniform heating for sintering ceramics, cermets and refractory metals at temperatures over 3000°F. Economical — can be used with reducing atmospheres for close-control research or full-scale production.



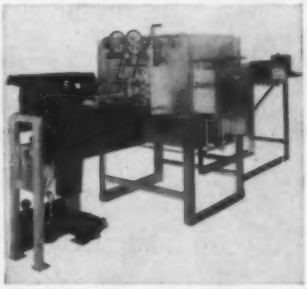
HAYES CONVEYOR FURNACES Types LAC (Straight Through) and BAC (Humpback®—Patented) . . . belt furnaces for continuous, automatic, uniform sintering of brass, bronze or iron compacts up to 2100°F. Available with zone temperature control . . . burn-off sections. For stainless steel work, etc.



HAYES MODEL HT/HV VACUUM FURNACES . . . high vacuum (0.1 micron), high temperature (3000°F plus) units for sintering special refractory metals — titanium, tungsten, zirconium, etc. Cold wall design. Low voltage elements. High-speed heating and cooling cycles.



HAYES TYPE BA-M PUSHER "Pilot Plant" FURNACES . . . inexpensive, for controlled atmospheres, straight-through design, controlled temperature cooling chambers. Manual or automatic operation to 2150°F for sintering powder metal compacts.



HAYES TYPE BA HIGH-PRODUCTION PUSHER FURNACES . . . wide-temperature-range furnaces designed for special sintering applications to 2350°F. Used with varied atmospheres . . . available with automatic, electro-hydraulic pusher system to maintain constant time/temperature cycles for batch or production. Good for stainless steel.

HAYES ATMOSPHERE EQUIPMENT . . . Ammonia Dissociator (shown). Also a complete line of exothermic and endothermic generators, Molecudryers for drying protective atmospheres to —100°F D. P.

sintering?

Hayes offers you the ***Right*** Furnace . . . and the ***Right*** Atmosphere for specialty or production sintering

Results Guaranteed! Hayes has the atmosphere or vacuum furnace to suit your requirements for sintering ferrous, non-ferrous, or refractory metals; stainless steel compacts; or cermets. Also, a complete line of controlled atmosphere equipment to assure you optimum results at lowest cost. Mail the coupon *today* for complete data on the Hayes sintering equipment you need . . . or for any allied products in Hayes world-famous CERTAIN CURTAIN electric furnace line.

ELECTRIC CERTAIN CURTAIN FURNACES

C. I. HAYES, INC.

Established 1905

819 WELLINGTON AVE. • CRANSTON 10, R. I.

FREE LITERATURE

Please send me complete data on sintering equipment suitable for:

- ☐ Ferrous or Non-Ferrous Compacts
- ☐ Ceramics or Refractory Metals
- ☐ Stainless Steel
- ☐ Atmosphere Equipment
- ☐ Specialty Sintering (you name it):

Name.....*Title*.....

Company.....

Street.....

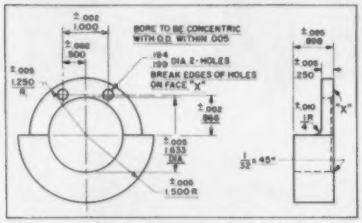
City.....*State*.....

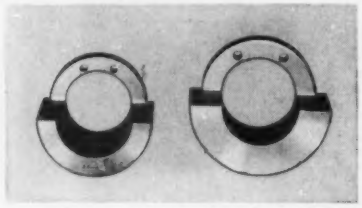
Circle No. 96 on Reader Service Card

News from CRANE on Powder Metallurgy

GRAY IRON CASTINGS VS. GRAY MATTER

Shown below are two of the 11 sizes of counterweights for crankshafts of refrigeration compressors. As the engineering drawing reveals, the tolerances are not too tight; offhand, it would appear to be an application for gray iron casting. And that's the way it used to be made.





Today, this same part is being made from Grade B-261D powder. (This is our own pre-mix of reduced iron powder plus graphite and zinc stearate.) The change-over to powder metallurgy was made in order to reduce manufacturing costs.

Unlike the casting, the powder part requires no machining. The powder is simply compressed to a uniform density of about 6 gm/cc in a press, sent through the sintering furnace, and the job is done. There are no costly hand finishing operations, and practically no rejects.

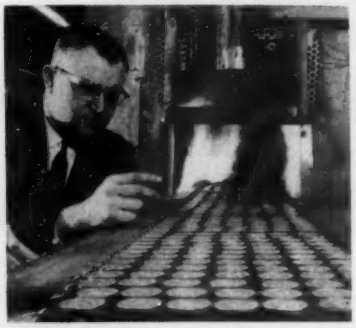
Interested in looking into the possibilities of converting some of your problems into solutions? More details are yours if you ask about *Item 1001*.

IRON ANNIVERSARY

We are celebrating our 25th year of operation right now. In place of the conventional Silver Anniversary, our theme is Iron—what else? Since we first began to manufacture metal powders as an outgrowth of some interesting investigations from a Fellowship at Mellon Institute, iron powders have been part of our business.

As a memento of the occasion, we asked one of our customers, Compacted Metals Corporation of Waukegan, Ill., to produce these medallions for us. The material of which they are made is our own Grade B-210 Iron Powder, blended with small amounts of graphite and zinc stearate. Although they bear a resemblance to coins, there was no actual coining operation involved in their production. They are simply iron powder, compacted in a 75-ton press, and sintered at 2060° F for 35 minutes.

Care to share our anniversary with us? You are welcome to one of our memento medallions; we'll see that you get one—and more information, too—if you request *Item 1003*.



Mr. Rudolph Capon, President of Compacted Metals Corporation, inspects a PM medallion just before it enters the sintering furnace.

AT THE DRAKE, SIR!

We hope you can be with us in Chicago on April 25, 26 and 27, where we will be exhibiting in the Powder Metallurgy Show at the Drake Hotel. Our station will be in Spaces 10 and 11, and we will enjoy renewing old acquaintances and greeting newcomers alike. Among the developments that have been going on in our company and our products this past year, there should be some items of mutual interest.

FOR MORE INFORMATION

Each item on this page represents only the highlights from a field or laboratory report. In most cases there is considerably more information available. If you are interested in some phase or would even like to see the complete report, drop us a note mentioning the item number.

PHYSICAL "FIT"NESS

When specs call for tough physical requirements, chances are they can be met by the judicious use of the right basic powders or mix. For instance, here are brief properties of two of our grades of iron powder and a competitive powder, compared to show changes in physicals resulting from adding 7% copper or 1% graphite, pressed at 30 tsi and sintered 30 min. at 2050°.

Many of our customers prefer to use our pre-blended grades of powder and have us blend to their specifications. This includes addition of appropriate compacting lubricants. They say they get a more uniform and reliable mix. If you would like more data on the physical changes wrought by varying combinations and amounts of additives refer to *Item 1002*.

	Iron Powder Only			Iron Powder...7% Copper			Iron Powder...1% Graphite		
	B-280	B-281	Comp.	B-280	B-281	Comp.	B-280	B-281	Comp.
Tensile*, psi	27,500	36,000	21,000	40,500	47,000	39,500	25,000	42,000	22,000
Elongation	6%	1%	8%	1%	.7%	.5%	2%	1%	3%
Mod. of Rupt., psi	68,500	72,000	52,100	77,500	98,500	74,500	59,200	94,000	48,000
Radial Growth	+.20%	−.40%	+.12%	+1.85%	+.90%	+1.80%	+.2%	+.25%	+.15%
Hardness	85	100	75	50	58	42	40	55	10
	(RH Scale)			(RB Scale)			(RB Scale)		

*Based on standard MPI test bar laboratory data for comparison only. Physical data for specific parts will vary because of structure, design and other factors.

Circle No. 89 on Reader Service Card

CRANE

METALS DIVISION

formerly Plastic Metals Div. of National-U.S. Radiator Corp.

3460 BRIDGE STREET
JOHNSTOWN, PA.

MEMBER: METAL POWDER INDUSTRIES FEDERATION

Taunton Engineering Works
700 W. Water St., Taunton, Mass.

The W. S. Tyler Co.
3615 Superior Ave., Cleveland 14, Ohio

Valenite Metals
Div. Veleron Corp.
Box 205, Royal Oak, Mich.

Vascoloy-Ramet Corp.
800 Market St., Waukegan, Ill.

Walsh Press & Die Co.
Div. of American Gage & Machine Co.
4709 W. Kinzie St., Chicago 44, Ill.

Welded Carbide Tool Co., Inc.
62 Colfax Ave., Clifton, N.J.

West Instrument Corp.
4363 W. Montrose Ave., Chicago, Ill.

The Winslow Co., Inc.
701 Lehigh Ave., Union, N. J.

Witco Chemical Co.
122 East 42, New York, N. Y.

POWDERS

Acheson Colloids Co.
1635 Washington Avenue, Port Huron, Mich.

Alan Wood Steel Co.
Conshohocken, Pa.

Aluminum Co. of America
Alcoa Bldg., Pittsburgh, Pa.

American Metal Climax, Inc.
1270 Avenue of the Americas, New York, N. Y.

Antara Chemicals
A Sales Division of General Aaneline & Film Corp.
435 Hudson St., New York 14, N. Y.

Belmont Smelting & Refining Works, Inc.
330 Belmont Ave., Brooklyn 7, N. Y.

Brush Beryllium Co.
5209 Euclid Ave., Cleveland 3, Ohio

Plastic Metals Division
The Crane Company
342 Madison Avenue, New York 17, N. Y.

Crucible Steel Co. of America
Spaulding Works
P. O. Box 32, Harrison, N. J.

Fansteel Metallurgical Corp.
N. Chicago, Ill.

Foote Mineral Co.
18 W. Chelten Ave., Philadelphia, Pa.

Freeman Corporation
91 Des Oblats Street,
Cap-de-la-Madeleine, Quebec, Canada

General Electric Co.
Lamp Metals & Components Dept.
21800 Tungsten Rd., Cleveland 17, Ohio

The Glidden Co.
Chemicals-Pigments-Metals Div.
P.O. Box 309, Hammond, Ind.

Circle No. 66 on Reader Service Card

STERLING

Powdered Metal Parts

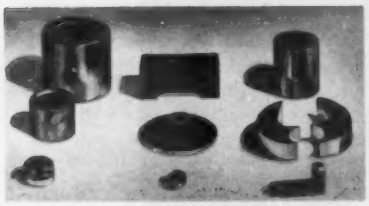
For better performance, quality engineering and cost reduction on bearings, bushings and structural parts in bronze, copper, brass, iron, stainless, nickel, silver, copper-infiltrated iron and special alloys.

For an alert interest in your production or design problems, write: POWDERED METAL PARTS DIVISION

STERLING ENGINEERING CORP.
WINSTED, CONN.

Eliminate costly machining with . . .

POWDERED METAL PARTS



Eliminate

CUTTING • DRILLING • SLOTTING
REAMING • WASTE

Let us quote on your parts in iron or bronze. Save up to 75%. Get the properties you need: high density, strength, ductility or porosity. Tell us your problem—we'll suggest a solution.

Send For Booklet

CARBON CITY PRODUCTS CO., INC.
FORD ROAD, ST. MARYS PA. • TEL. TE 4-2887

Circle No. 93 on Reader Service Card

GRC tiny die castings

made in one fast automatic operation ...simple or intricate parts, high in quality, low in cost

Gries' exclusive patented methods make possible wide design latitude . . . assure uniformity, accuracy and smooth surfaces on small parts of all types . . . for a wide variety of uses . . . at substantial savings. GRC die castings leave the machines trimmed, ready-for-use. In addition GRC's unique single cavity die casting techniques offer new short-cuts in assembly . . . new approaches in product design through our exclusive methods.

tiny zinc die castings

NO SIZE TOO SMALL!
Maximum sizes up to 1¾", ½ oz.

Write for fact-filled booklet "Small Zinc Alloy Die Castings." Includes helpful designer's check list.

25 years of progress in tiny parts

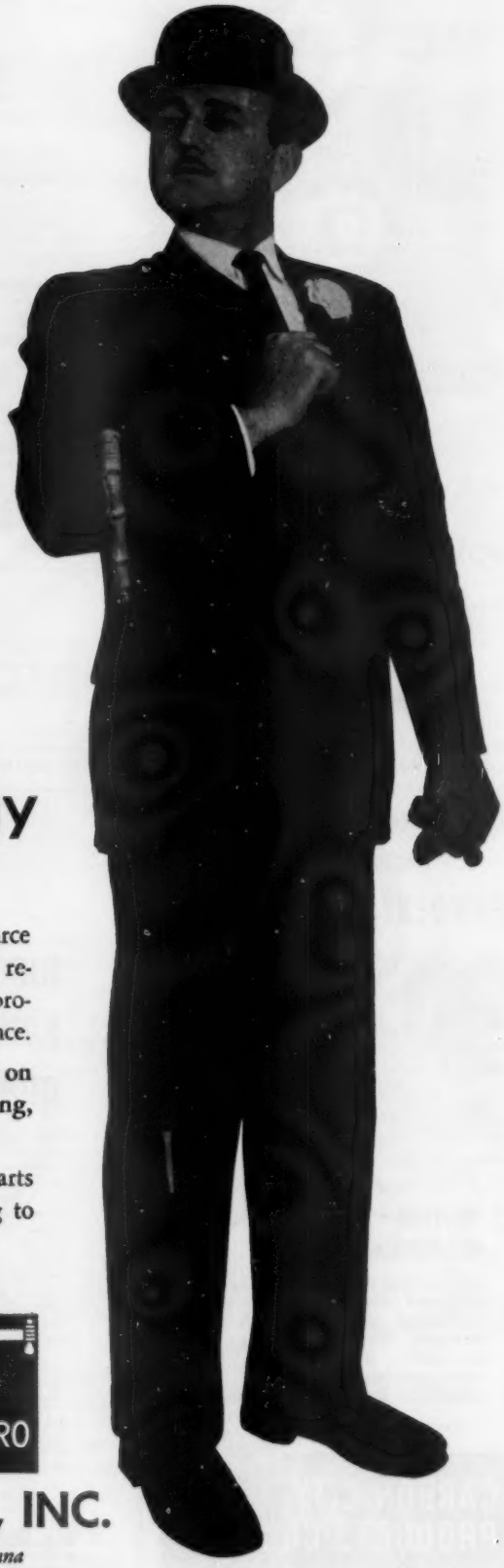
GRIES REPRODUCER CORP. GRIES
World's Foremost Producer of Small Die Castings
157 Beechwood Ave., New Rochelle, N. Y. • NEw Rochelle 3-8600

Circle No. 35 on Reader Service Card

for the REALLY discriminating

user

of Powder Metallurgy Components



Of course you must be particular when selecting a source for powder metallurgy parts. Absolute reliability is required. The skillful buyer seeks the supplier that can provide advanced technical, design and engineering assistance.

That's why so many major industrial firms call on FERRO to translate their requirements into cost-saving, highly efficient powder metallurgy components.

Whenever your business needs powder metallurgy parts or research . . . or design and engineering pertaining to such components . . . call

FERRO

FERRO POWDERED METALS, INC.

Salem, Indiana
Telephone 702

Circle No. 32 on Reader Service Card

Greenback Industries, Inc.
2527 W. Maple Rd., Birmingham, Mich.

Handy & Harman
82 Fulton St., New York 38, N. Y.

Charles Hardy, Inc.
420 Lexington Ave., New York 17, N. Y.

Hoeganaes Sponge Iron Corp.
P. O. Box 192, Riverton, N. J.

The International Nickel Co., Inc.
67 Wall St., New York 5, N. Y.

A. Johnson & Co., Inc.
21 West St., New York 6, N. Y.

Kulite Tungsten Co.
1040 Hoyt Ave., Ridgefield, N. J.

Magnetic Powders, Inc.
Fairview Ave., Johnsonburg, Pa.

Malone Metal Powders, Inc.
Route #202, Flemington, N. J.

Metal Atomizing & Processing Corp. Ltd.
P.O. Box 325, 1437-39 Speers Rd.,
Oakville, Ontario, Canada

Metal Hydrides, Inc.
20 Congress St., Beverly, Mass.

Metal Powders, Inc.
15 St. Joseph St., Lachine, Quebec, Can.

Metals Disintegrating Co., Inc.
P. O. Box 290, Elizabeth "B", N. J.

Metals & Residues, Inc.
65 Brown Ave., Springfield, N. J.

Micronized Metals, Inc.
38-13 Tenth St., Long Island City, N. Y.

National Lead Co.
111 Broadway, New York 6, N. Y.

New Jersey Zinc Co.
160 Front St., New York 38, N. Y.

Powder Metals Research, Inc.
1036 Hoyt Ave., Ridgefield, N. J.

Pyron Corp.
P.O. Box E., LaSalle Station, Niagara Fall, N. Y.

Republic Steel Corp.
Metal Powder Div.
P.O. Box 338, Station A, Toledo 5, Ohio

Reynolds Metals Co.
6601 W. Broad St., Richmond, Va.

Sherritt Gordon Mines Ltd.
Fort Saskatchewan, Alberta, Can.

Southwestern Graphite Company
Graphite Rd., Burnet, Texas

Sylvania Electric Products, Inc.
Chemical & Metallurgical Div.
Towanda, Pa.

United International Research
38-15 30th St., Long Island City 1, N. Y.

U. S. Bronze Powder Works, Inc.
Route #202, Flemington, N. J.

Vanadium-Alloys Steel Co.
Latrobe, Pa.

Vascoloy-Ramet Corporation
800 Market Street, Waukegan, Illinois

Whitaker Metals Corp.
1301 Burlington St., N. Kansas City, Mo.

C. K. Williams & Co.
2001 Lynch Ave., E. St. Louis, Ill.

MPIF PROGRAM

The technical program for the 16th annual meeting of the Metal Powder Industries Federation has been announced. Meetings will be at the Drake Hotel, April 26 and 27. The MPIF show will run April 25 to 28.

Ultrasonic Testing of Powder Metallurgy Parts
E.H. Abbe & R.D. Korytoski, Springfield Armory

Machinability of Sintered Iron—A Supplement to Report Given at

continued on page 97

TADANAC BRAND

SPECIAL HIGH GRADE

ZINC

As the world's largest lead-zinc producer, we can make prompt delivery when you order electrolytically refined TADANAC Brand Special High Grade zinc. Our production is geared to meet punctually your requests for TADANAC Brand Special High Grade formulated to your specifications.

TADANAC Brand Special High Grade zinc slabs have recently been redesigned with strapping slots and hand-holds so they will travel better and be easier to handle.

All TADANAC Brand zinc is electrolytically refined to give die-casters a consistently high quality product, for greater design flexibility, more exacting dimensional tolerances and better finishes.

Cominco's Technical Service staff has had broad experience in the die-casting field and will be glad to help you get the very best castings from TADANAC Brand zinc.

Buy TADANAC Brand zinc for convenience, quality and service.

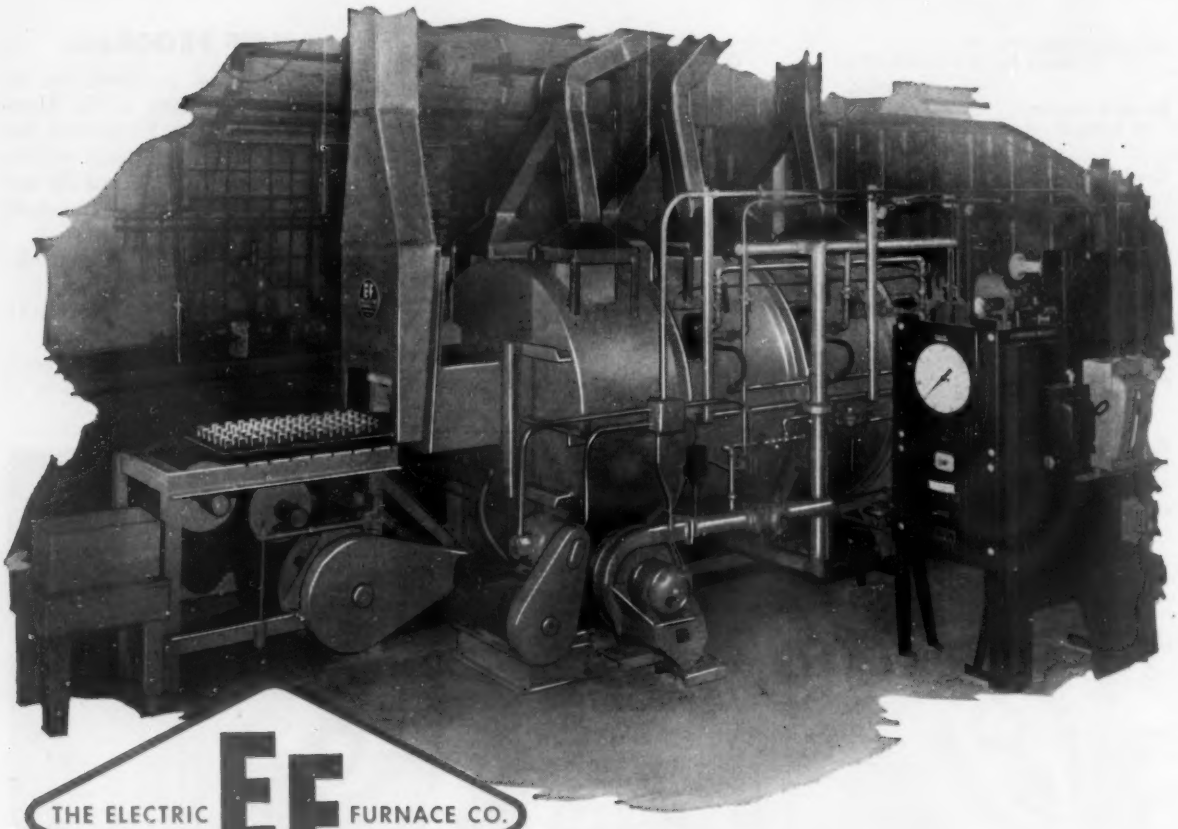
COMINCO

THE CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA LIMITED
Toronto WORLD'S LARGEST LEAD-ZINC PRODUCER Montreal

Tadanac Brand Metals are sold in United States by American Metal Climax, Inc., New York, Chicago, Detroit, Los Angeles

0147

Circle No. 22 on Reader Service Card



THE ELECTRIC EF FURNACE CO.

GAS • OIL • ELECTRIC

Sintering Furnaces

for processing metal powder products and bonding metal powder to strip

Wide experience in sintering ferrous and non-ferrous pressed metal products of different analysis, shape and size; bonding powder to strip, and other "powdered metal" heat treatments. Installations in daily operation range from small fuel fired or electrically heated wire mesh belt furnaces to high production combination fuel fired and electrically heated roller hearth furnaces more than 100 feet long.

The treatment varies with the powders being processed. The green compacts are sometimes carried through the furnace directly on a wire mesh belt,— but more frequently are loaded on trays, which in turn are moved through the furnace on a wire mesh belt or roller hearth conveyor. Use of a heat resisting alloy muffle tube, or radiant tube heating elements, in fuel fired furnaces, eliminates any contamination of the work with flue products, and permits exact atmosphere control. Outputs to meet *any* production requirement.

A thorough understanding of the problems involved, and careful engineering, assure production of a high quality product, of unvarying uniformity, that finds highest market acceptance.

Ask us also about our wide experience in designing and building furnaces for annealing, normalizing, hardening, carburizing, nitriding, carbon restoration, galvanizing, coating, brazing, billet heating, malleablizing and other heat treatments.

For any ferrous or non-ferrous furnace heat treating project you will find "It pays to call the EF heat treating engineers". Let us work with *you* on *your* next project.

SEND FOR BULLETIN NO. 591

Twenty pages. It illustrates and describes the many different types of furnaces we build, and the applications in which each is used. **Write for your copy TODAY!**

EF

THE ELECTRIC FURNACE CO.

Gas-fired, Oil-fired and Electric Furnaces for Heat Treating any Product, Using any Process, any Hourly Output.

550 West Wilson Street *Salem - Ohio*

Branch Offices in Detroit, Mich., Santa Ana, Calif., and Cheshire, Conn. Canadian Associates, Canefco Limited, Toronto 13, Ontario

Circle No. 31 on Reader Service Card

MPIF PROGRAM *cont.*

15th Annual Meeting
R.S. Jamison & E. Geijer, Hoeganaes Sponge Iron Corp.

Basis for Non-Destructive Testing of Cemented Carbide
W.O. Woods, Watertown Arsenal

Process Controls for Quality and Quantity in Powder Metallurgy Parts Production
W.R. Anderson, The Maytag Co.

Checking Density Variations in Powder Metallurgy Parts By Means of Eddy Currents
R. Kenton, Magnaflux Corp.

The Effect of Powder Particle Size Distribution on the Sintering of Molybdenum
A.R. Poster & C.T. Waldo, Sylvania Electric Products, Inc., & H.H. Hausner, Consultant

Chic Sale Looks at Powder Metallurgy
V.R. Toeplitz, Bound Brook Oil-Less Bearing Co.

Heat Treatable Steel Bonded Carbides—New Construction Materials for Tools and Wear Resistant Components
J.L. Ellis, Sintercast Div., Chromalloy Corp. &
E. Gregory, Air Reduction Co. Inc.

Sintered Nickel Steels—The Path to Improved Properties.
W.V. Knopp, S-K-C Research Associates

FUNDAMENTALS OF POWDER METALLURGY LECTURE
N.J. Grant, Massachusetts Institute of Technology

Application of Stainless Steel Powder Metallurgy
W.L. Batten, Vanadium-Alloys Steel Co.

Application Engineering Applied to Powder Metallurgy
R.B. Thomson, U.S. Graphite Co.

Low Temperature Impact Strength of Sintered Steels
L. Menezes, Picatinny Arsenal

Aircraft Superalloys By Powder Metallurgy
M.W. Toaz, G.F. Davies & R.D. Johnson, Clevite Corp.

Nickel-Coated Composite Powders —Compacting and Sintering Characteristics
J.A. Lund, T. Krantz & V.N. Mackiw, Sherritt Gordon Mines Ltd.

The Outlook for Metal Powders and Powder Metallurgy
K.H. Roll, Metal Powder Industries Federation

1960 International Powder Metallurgy Conference—A Preview
F.V. Lenel, Rensselaer Polytechnic Institute

The Testing of Magnetic Powders for Electronic Core Applications
T.A. Dunton, Mond Nickel Co. Ltd., England

Contribution to the Evaluation of Magnetic Materials
J.A. Roberts & G. Ludewig, General Aniline and Film Corp.

An Equipment For Measuring The Temperature Coefficient Of Permeability Of Powder Cores
T.A. Dunton, Mond Nickel Co. Ltd., England

WEDNESDAY, APRIL 26
POWDER METALLURGY PARTS SEMINAR
Ballroom

Sponsored by manufacturers of power metallurgy parts, Members of the Metal Powder Industries Federation and the Powder Metallurgy Parts Manufacturers Association

Open to all registrants and invited guests free of charge

FOR COMPLETE DIE CASTING SERVICE

After 30 years of serving the die casting industry we have expanded to offer you complete die casting service.

DESIGN —
Our staff of experienced die casting engineers stay with the job from initial design to finished casting.

DIE CASTING —
Complete facilities to produce castings weighing 14 lbs. zinc.

PLATING —
Plating of all sizes, weights, and types available, from barrel zinc to the most difficult, automobile bumpers.

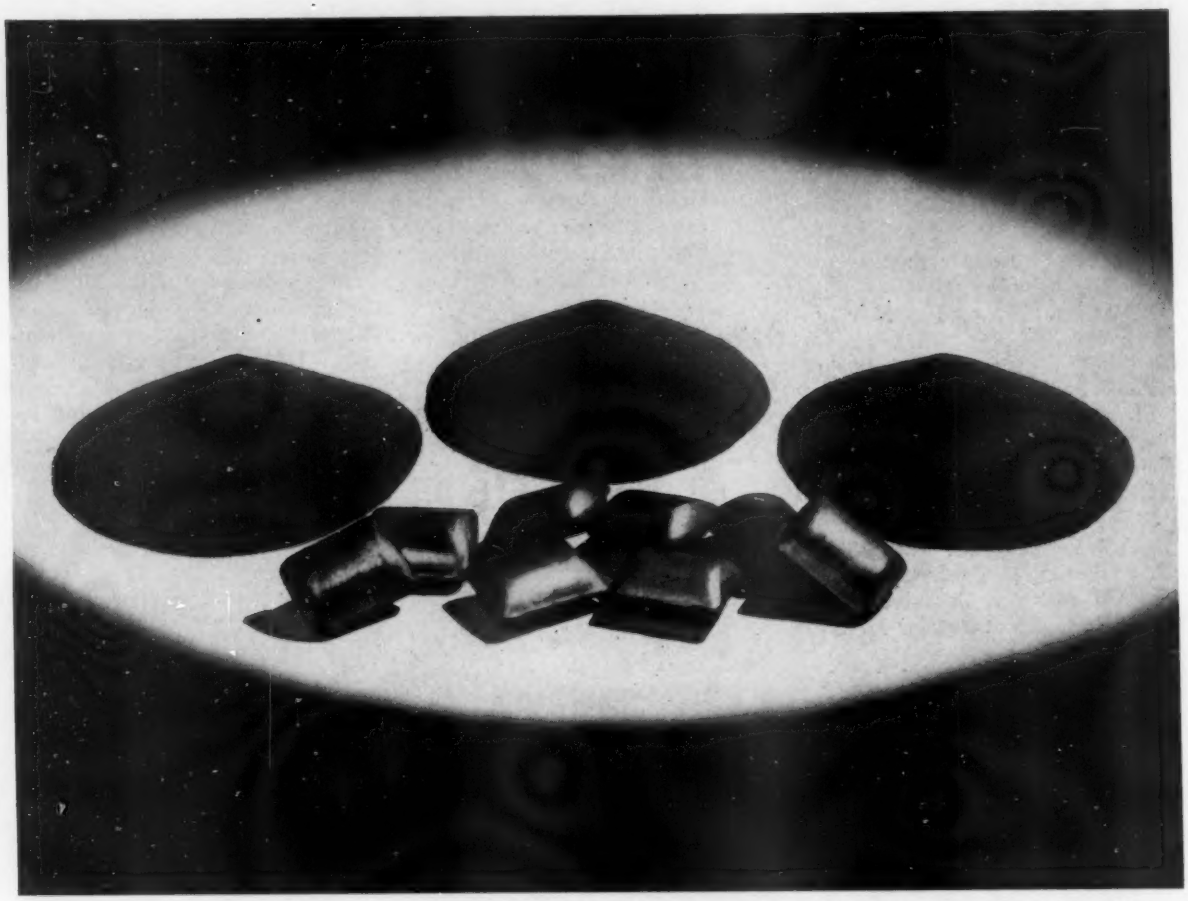
LABORATORY & INSPECTION FACILITIES —
Our laboratory and inspection facilities is your assurance of quality castings.

DiSalle

The DiSalle Plating & Die Casting Co., Inc.

2851 South Ave.
Toledo 9, Ohio

Circle No. 29 on Reader Service Card



Sherritt High-Purity Nickel is available in handy briquettes (1¼" x 1½" x ⅝") and in three grades of powder—Grade C (coarse), Grade F (fine), and Grade S (medium).

nickel as you like it

Nickel as you like it . . . *in purity, in handling ease, and in alloying efficiencies.* Sherritt's unique hydrometallurgical refining process yields nickel powders with a guaranteed purity of better than 99.8%. Available in briquettes and in three grades of powder, Sherritt nickel takes all prizes for handling ease. There are no strips to cut, no unwieldy plates to handle. Alloying is quicker and less troublesome. By disintegrating into smaller agglomerates, Sherritt powders and briquettes go into solution more rapidly with less chilling. This low-chilling property permits alloying additions even at the end of the heat. Sherritt also offers special grades and coated powders.

SHERRITT

FOOTE MINERAL COMPANY is the exclusive sales agent for Sherritt nickel and cobalt in the United States and Canada. For product literature, prices, and delivery information, contact the Foote Mineral Company, 474S Eighteen West Chelten Building, Philadelphia 44, Pa.

SHERRITT GORDON MINES LIMITED

Circle No. 94 on Reader Service Card

INVESTMENT CASTING CLINIC

The second Investment Casting Clinic will be held at the Essex House, Newark, N.J. on May 9, 1960.

The schedule for the clinic is for two workshop sessions, one in the morning and a duplicate session in the afternoon. The tentative plans call for:

1. Introductory Session—This will include the showing of slides which illustrate the method of production of investment castings, also an explanation of the balance of the clinic session.
2. Workshop "A"—Specifications and Design. This will aim at educating users of investment castings on the various data which are needed by the casting manufacturer so that he can bid intelligently and then produce the part to specifications. The design concept of this session will include material published in the ICI book as well as more detailed design material.
3. Workshop "B"—Alloys and Applications. Separate discussions on ferrous and nonferrous alloys. This will include properties as investment cast, heat treatment, castability, etc. The applications discussion will be divided into case history applications in aircraft and in commercial applications. The discussion will also cover the relation of investment casting to screw machine parts, sand castings, die castings, and powder metal parts.

In addition to the workshops there will be a display of typical investment castings in some eight different categories.

A nominal charge will be made for the clinic sessions.

Full information about the clinic can be secured from the Investment Casting Institute, 27 E. Monroe St., Chicago, Ill.

DOLLIN APPOINTS EYNON CO.

Gordon C. Curry, vice president in charge of sales, Dollin Corporation, Irvington, N.J., announces the appointment of Eynon Company, Detroit, Michigan as sales and engineering representatives for Dollin zinc and aluminum die castings in the state of Michigan, plus Toledo, Ohio and South Bend, Indiana.

SELLERS OF

'METALKAT'
BRAND ELECTROLYTIC ZINC
SPECIAL HIGH GRADE 99.995% +
HIGH GRADE 99.95%

INDUSSA CORPORATION
511 Fifth Avenue New York 17, New York Tel: MUrray Hill 2-4680
Cable: Indussa New York Telex: 4301 New York

Circle No. 42 on Reader Service Card

REFERENCE FACTS
ABOUT
BROCKWAY
"SELF-LUBRICATING"
METAL PARTS

Smooth surface finishes and close tolerances on long, high speed production runs are typical with Brockway Metal Parts. Because the production methods involved result in such amazing cost reductions, questions frequently arise concerning the true nature of pressed metals. Outlined below are those characteristics generally considered most important.

POROSITY may be controlled to range from 15% to 35% by volume. Pores can be sealed by special impregnation.

WELDING and brazing procedures are similar to those for cast metals. Complete knowledge of metallic-mixes enables Brockway to recommend best alloys for these purposes.

PEENING, riveting or swaging requirements should be specified. Brockway produces parts with the exact malleability needed for such processing.

SOLDERING of iron or bronze parts presents no problem so long as the parts have been thoroughly cleaned in advance.

DRILLING and tapping procedures generally follow those used for cast iron. Tool requirements should follow manufacturer recommendations.

GRINDING can be performed where necessary. Manufacturer's recommendations should be followed as to types of grinding wheels to be used.

REAMING can be done without sacrificing porosity of self-lubricating qualities by use of carbide tipped tools.

REMOVING OIL is accomplished by washing parts in good grade, commercial solvent or by burning in controlled atmosphere.

MACHINING is used as a secondary operation when desired shape cannot be obtained in the initial briquetting operation. Since machining tends to reduce porosity, bearing surfaces are not usually machined. Machining should be done without using a coolant so as not to interfere with the natural impregnation of the part.

PLATING of powdered metal parts produces excellent results so long as absorption of plating solution salts is guarded against. This is especially true with iron powder parts where the salts may cause internal corrosion.

Send for Free Bulletin
Circle No. 98 on Reader Service Card

DIE MAKERS — DIE CASTERS

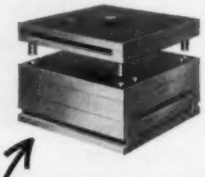
Standardize with D-M-E and Save!

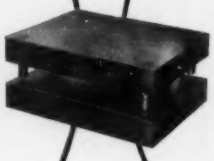
Reduce design time and cut die construction costs with these D-M-E STANDARDS—combined to fit your needs!

For added savings, start with D-M-E Standards—they're "better to begin with" because they're made of the finest steel, finish-ground flat and square. Only D-M-E Standards give you "custom-made" construction with the cost-saving benefits of standardized, interchangeable components.

RACK and PINION EJECTION

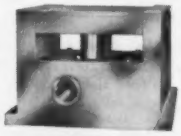
HYDRAULIC EJECTION



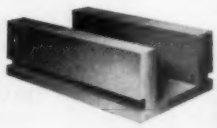


D-M-E Standard Cavity Retainer Sets

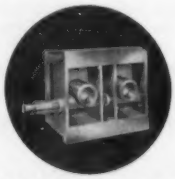
From 9⅞" x 8" to 23¾" x 35½"



D-M-E Standard EJECTOR BOXES up to 18" x 35½"



D-M-E Standard EJECTOR HOUSINGS up to 23¾" x 35½"



Welded Steel Construction (Patented)—30% lighter than cast-iron boxes!

Write for 170 page D-M-E Catalog, listing complete data and prices—or call or write your nearest D-M-E Branch TODAY for additional information.

58-E

DME **DETROIT MOLD ENGINEERING CO.**

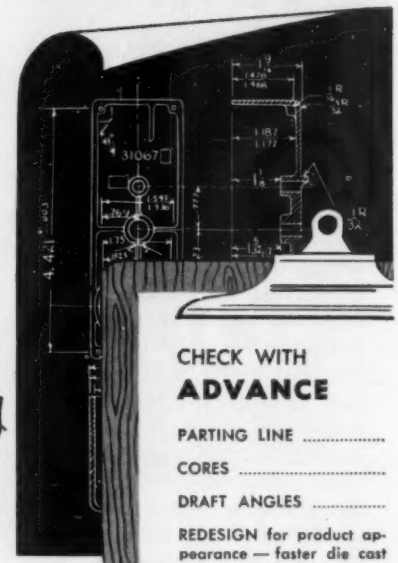
Contact Your nearest Branch for Faster Deliveries!

- DETROIT: 6686 E. McNichols Rd.—CHICAGO: 5901 W. Division St.
  HILLSIDE, N.J.: 1217 Central Ave.—LOS ANGELES: 3700 S. Main St.
- D-M-E CORP., CLEVELAND: 502 Brookpark Rd.—DAYTON: 558 Leo St.
- D-M-E of CANADA, Inc., TORONTO, ONT.: 156 Norseman Ave.

Circle No. 25 on Reader Service Card

FOR DIE CAST COMPONENTS

Let's start with your *Preliminary* **print**



CHECK WITH **ADVANCE**

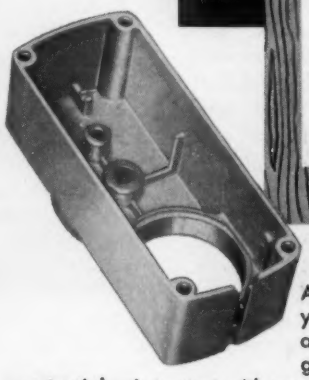
PARTING LINE .....

CORES .....

DRAFT ANGLES .....

REDESIGN for product appearance — faster die cast production .....

DIMENSION CONTROL POINTS .....



A good way to improve your product's appearance — lower its cost — give impetus to its sales potential — is to start with your preliminary drawings.

Particularly with zinc and aluminum die cast components, early planning solves many a design and production problem with happy advantages both to manufacturing economy and market appeal.

Yes . . . for new product design . . . or redesign of existing products to improve market position . . . check your die cast component parts with ADVANCE . . . *starting with early preliminary drawings.*

These symbols are your assurance of highest quality zinc and aluminum alloys under ASTM standards.

DIE CASTING RESEARCH FOUNDATION PARTICIPANT

ADVANCE TOOL AND DIE CASTING CO.

3782 N. Holton St.
Milwaukee 12, Wis.

Serving industry since 1920

Circle No. 4 on Reader Service Card

SMELTERS ASK FOR SCRAP EXPORT LIMITS

Spokesmen for the nation's aluminum smelting industry renewed their request that the Commerce Department curtail the scrap export rate of aluminum on the grounds that the flow will "seriously injure a domestic industry and bring an inflationary impact in the 1960's."

Renewing a request that was initiated by a smelter petition last July, Carl H. Burton, secretary of the Aluminum Smelters Research Institute, Chicago, told the U.S. Department of Commerce that nothing, save immediate government action, can prevent "large scale disorder" resulting from heavy rates of scrap export.

Burton said that while Bureau of Mines figures showed an aluminum scrap supply increase of 24 per cent in 1959 over 1958, smelter scrap requirements soared 41 per cent, to about 365,000 tons. He also pointed out that, although smelter scrap inventories on Jan. 1, 1960 were 11.5 per cent higher than the same date last year, unfilled ingot orders were up 69.1 per cent.

Circle No. 108 on Reader Service Card

SPONGE IRON POWDERS
For:
Structural Parts
Welding Electrodes
Flame Cutting

Heat Treatable Iron Alloy Powders
Completely Prealloyed, Good Compressibility
Hydrogen Annealed Sponge Iron Powders
For High Density Parts
Also Non-Ferrous Alloy And Carbide Powders

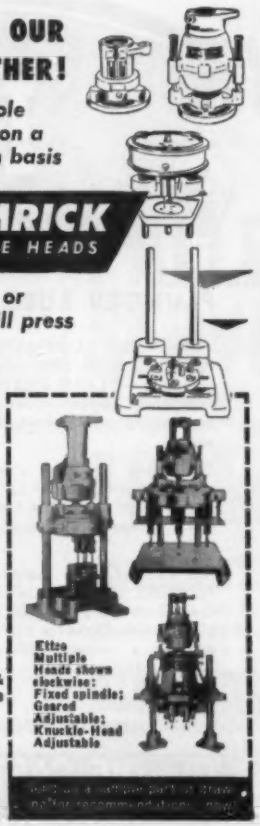
METAL POWDERS, INC.
Division of Dominion Tar & Chemical Co., Ltd.
15 St. Joseph St. Lachine, Quebec, Canada
Plants at Iberville and Lachine, Quebec

LET'S PUT OUR MULTIPLE HEADS TOGETHER!
. . . and plan your small hole drilling & tapping operation on a low cost, maximum production basis

ETTCO-EMRICK
MULTIPLE SPINDLE HEADS
UNIT-ENGINEERED for drilling or tapping on any drill press

No one type will do for every job. That's why we make 'em all—and the correct custom tooling for faster handling of the parts. The Ettco system is a completely integrated service; not just multiple heads with spindles reaching into the air!

Ettco engineers can tell you without obligation which type best suits your specific job. They're all easily attachable to your present drill press, tapping machine or automated special. Standardized, reuseable components mean lowered costs. Interchangeable face plates permit quick switch from tapping to drilling. Write for catalog.

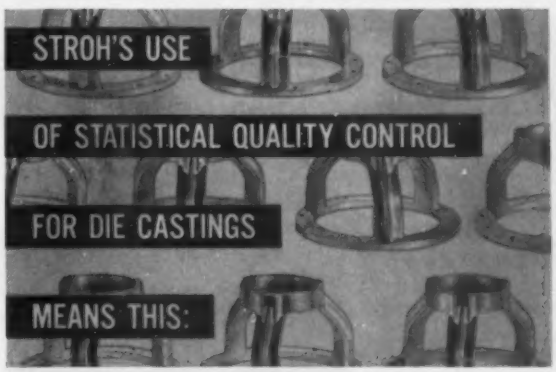


Ettco Multiple Heads shown clockwise: Fixed spindle; Geared Adjustable; Knuckle-Head Adjustable

Ettco-Emrick
The only complete line manufacturer of drilling & tapping equipment for the entire small hole field

ETTCO TOOL & MACHINE CO., INC.
586 Johnson Avenue, Brooklyn 37, N.Y.
Visit Booth 1760 at the ASTE Show

Circle No. 74 on Reader Service Card



1 ASSURES ACCURATE PARTS: Critical dimensions can be held within specified limits.

2 LOWER INSPECTION COSTS: Lower costs come from your needing only a simple receiving inspection instead of a full sampling of each shipment of die castings.

3 UNIFORM HIGH QUALITY: This new concept of quality control for die castings means that buyers of die castings who rely on statistical dimensioning are assured of accurate parts ready for assembly.

LET US SHOW YOU how you can benefit. Many major manufacturers are now benefiting from the excellent results and the lower costs.

Stroh Die Casting Co., Inc.
11123 W. BURLIEGH ST.
MILWAUKEE 10, WISCONSIN
IN OUR 57TH YEAR

Circle No. 67 on Reader Service Card

Circle No. 27 on Reader Service Card

DIECRAFT
TOOL COMPANY
QUALITY
AND
PRECISION

Manufacturers of

* Sintered Metal Tools

* Carbide SPECIALISTS

1275 Thomaston Avenue
Waterbury 14, Conn.
PLaza 5-8630

NEW PRODUCTS *cont.*

INSULATING BRICK

IPSEN INDUSTRIES, INC. — A new ceramic insulating brick has the weight of a 1600°F brick, but the insulating value of a 2300°F brick. It can be operated to 3400°F. The interconnected cellular structure permits gas to pass through for purging or evacuation.

Circle No. 238 on Reader Service Card

COATED ABRASIVE

BEHR-MANNING CO. — Metalite Type 101 abrasive has a resin-bonded aluminum oxide coating. It has shown extreme sharpness, increased life and cooler cutting. Grit shedding is held to a minimum.

Circle No. 239 on Reader Service Card

CLEANING MACHINE

ALVEY-FERGUSON CO. — The "Surg-A-Flow" cleans metal parts and assemblies in sizes up to engine blocks. The small, low-priced unit is thoroughly job tested. A battery of machines permit multiple stage operations involving washing, rinsing or dipping in oil.

Circle No. 240 on Reader Service Card

COATING MACHINE

CONFORMING MATRIX CORP. — has developed a new machine for the accurate coating of coaxial lead components. The completely automatic unit sprays electronic parts with a resinous composition to form a light-tight seal. It leaves no excess coating.

Circle No. 241 on Reader Service Card

PLATING CYLINDER

HANSON-VAN WINKEL-MUNNING CO. — A plexiglas, belt driven plating cylinder has its own motor drive, eliminating the need for tank motors. It permits more thorough rinsing because constant cylinder rotation causes less drag-out from tank to tank.

Circle No. 242 on Reader Service Card

PYROMETER

ILLINOIS TESTING LABORATORIES — has introduced a portable indicating pyrometer primarily intended for temperatures not far from room temperature. A selection of thermocouples is available, so the unit can be used for many different kinds of temperature measurement.

Circle No. 243 on Reader Service Card

DETAILS OF PLASTIC PATTERNMAKING REVEALED

Free!

SEND FOR YOUR COPY TODAY!

Describes Ten Major Pattern Applications

Eight big pages of technical facts, mixing proportions, curing data, pot life, results in application, coatings, release agents and new safety hardeners. Send for your free copy today.

SEE US AT BOOTH 732, CONVENTION HALL
AFS CASTING CONGRESS AND CONVENTION

furane plastics INCORPORATED
4516 Brazil St., Los Angeles 39, Calif.
42 Chasner St., Hempstead, L.I. N.Y.

Circle No. 91 on Reader Service Card

DIE CASTING "ID"
IMPROVEMENT & DEVELOPMENT CORP

PLUNGER LUBE #400

A NEW DEVELOPMENT, PLUNGER LUBE #400 offers complete—STAIN FREE—plunger tip lubrication, reducing casting rejects from this cause.

Containing fine mesh aluminum powder PLUNGER LUBE #400 is light bodied in automatic plunger tip lubrication systems.

An exceptional material, PLUNGER LUBE #400 is also used successfully as a CORE LUBE, brushed into the cavity, and as a solvent reduced SPRAY BASE.

FOR COMPLETE INFORMATION WRITE TO:

The DIE CASTING "ID" CORP.
4902 LEDGE AVE. NORTH HOLLYWOOD, CALIF.

Circle No. 26 on Reader Service Card

THERMOCOUPLES

CONAX CORP. — Con-O-Clad mineral insulated thermocouples can be bent into any configuration. They have a high temperature range, small size, fast response rate and long life. The units are shock and vibration proof, corrosion resistant, and color coded for type of sheath metal and calibration.

Circle No. 244 on Reader Service Card

TROLLEY CONVEYOR

RAPISTAN - KEYSTONE, INC. — The Model 348 overhead trolley conveyor system is factory lubricated for running through dry ovens and other high-temperature applications. It is mounted on a standard 3" I-beam track and is interchangeable with other systems.

Circle No. 245 on Reader Service Card

THERMOCOUPLE ADAPTER

THERMO ELECTRIC CO.—A thermocouple adapter converts tubular thermocouples to spring-loaded, adjustable immersion length types. It allows temperature measurement at varying immersion depths in systems where a fixed thermocouple would be impractical. The unit compensates for expansion, contraction and vibration.

Circle No. 246 on Reader Service Card

PAINT AGITATORS

SPRAYMATION, INC. — This explosion proof paint agitator will not be damaged by stalling or overloading. The variable speed unit can be used with automatic or hand guns, or fitted to paint cups. A special model is used for the agitation of critical ceramic and metallic materials.

Circle No. 247 on Reader Service Card

IONIZATION GAUGE

NRC EQUIPMENT CORP. — The Model 527 vacuum ionization gauge will not burn out if exposed to air. The coated iridium filament is expected to last five times as long as the conventional tungsten filaments. It also holds up better under shock and vibration.

Circle No. 248 on Reader Service Card

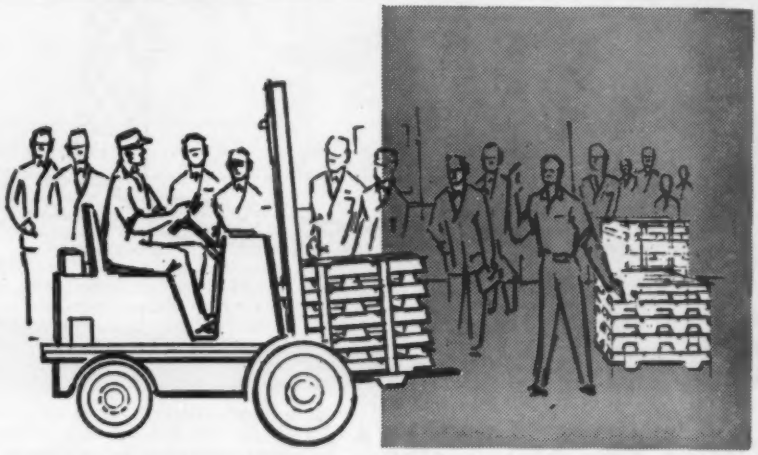
NEW SERVICE FOR DIE CASTING INDUSTRY

New facilities and services for rebuilding and modernizing die casting machines, are now offered by Mr. Joseph Kaul, formerly chief equipment engineer of Doehler Jarvis Co., thru his new firm—Die Cast Machinery Inc. of 409 Earl Street, Toledo 5, Ohio.

Assisting in obtaining and selling machines, is Mr. Fred C. Ziesenheim, M.E., of King Avenue, Marion, Ohio; formerly sales manager of Lester Phoenix Inc. and of Hydraulic Press Mfg. Co. Mr. Kaul's exceptional experience of over 32 years in designing and building machines, and in literally rebuilding thousands, assures good design and workmanship, done economically.

NEW DIRECTOR OF RESEARCH AT VESUVIUS CRUCIBLE

S. Eugene Weed has been appointed director of research and development at Vesuvius Crucible Company, Swissvale, Pa. succeeding Charles A. Styer who retired.



EVERYONE GETS PALLETIZED SERVICE

(or whatever kind of service you want)

FROM HENNING

You don't need big-company equipment to get palletized service from HB&S. Our delivery trucks not only have hydraulic tailgates to drop the palletized material to sidewalk level, but also carry along a small hand-operated hydraulic lift-truck to roll the material to any point *within your plant!*

HB&S service is **personalized** to fit your needs just as HB&S alloys are specifically engineered, quality-controlled from start to finish, to meet your casting needs.

See what a difference HB&S service . . . HB&S quality make in better casting results . . . lower costs.

Smelters and refiners of aluminum, bronze, brass, zinc, lead. Distributors of Olin Prime Aluminum

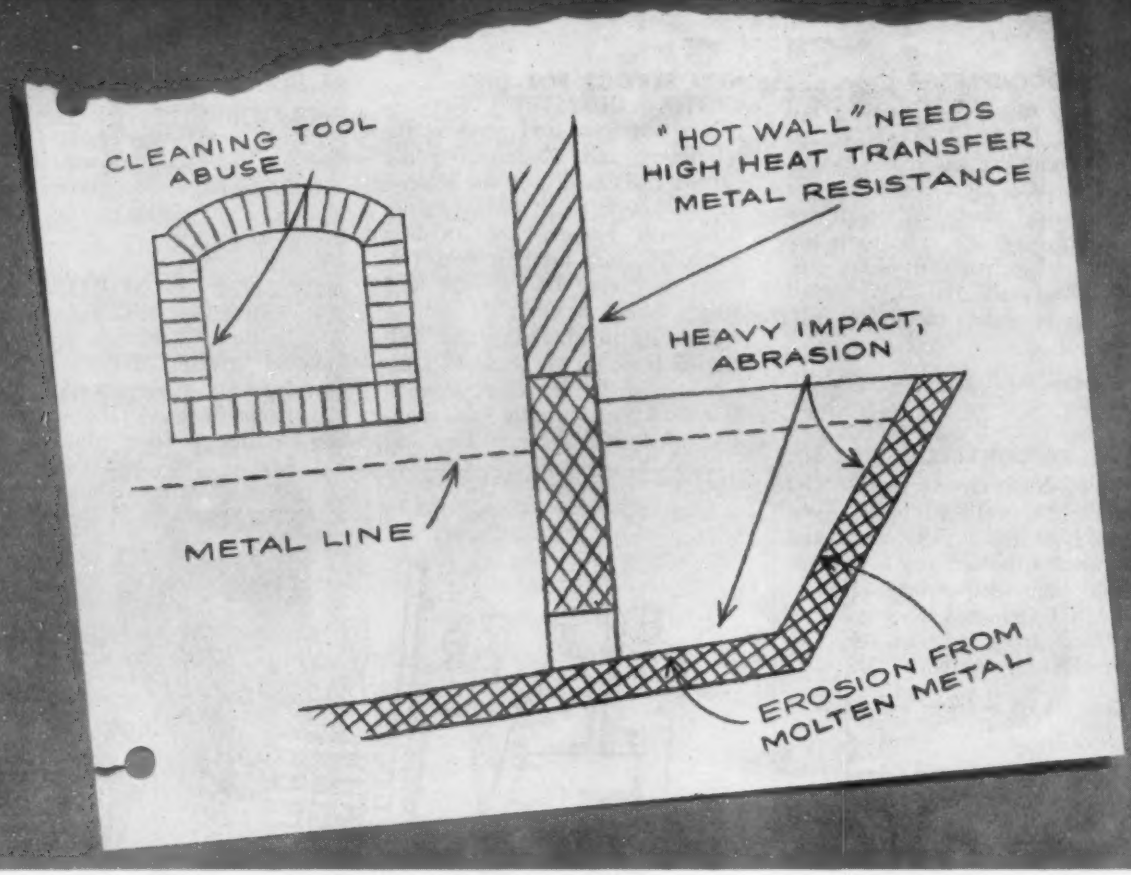
Write NOW for this FREE reference book and guide to help you in selecting your die castings alloys. It's loaded with FACTS.

HENNING BROS. & SMITH, INC.

Dependable service since 1922

91-117 Scott Ave., at Randolph St., Brooklyn, N. Y.
Phone: HYacinth 7-3470

Circle No. 37 on Reader Service Card


CLEANING TOOL ABUSE
"HOT WALL" NEEDS HIGH HEAT TRANSFER METAL RESISTANCE
HEAVY IMPACT, ABRASION
METAL LINE
EROSION FROM MOLTEN METAL

Design hints on refractories for aluminum furnaces

How to help charging ramps take the gaff of impact and abrasion

Nine-inch soldier courses and 4½" rowlock courses of CARBOFRAX® 10-D silicon carbide brick, with thin trowelled joints, provide the most effective answer to abuse encountered at the charging ramps of reverberatory-type aluminum melting furnaces. This is the experience of leading furnace users throughout the country.

CARBOFRAX brick have the exceptional wear-resisting properties necessary to stand up under the impact and abrasion of charging ingots and scrap. In addition, they have high resistance to penetration, erosion and attack by molten aluminum, contributing to long service life and reduction of metal losses due to absorption by refractories.

Special-purpose refractories made by Carborundum offer a choice of materials to meet widely varying needs in all critical areas of aluminum melting furnaces.

CARBOFRAX *ceramic-bonded silicon carbide*, for example, is made in a variety of compositions suitable for hot walls, side walls, bottoms, charging ramps and door jambs and sills. REFRAX® *silicon-nitride-bonded silicon carbide* can be supplied in accurately dimensioned shapes with high strength and resistance to thermal shock. It is not wet by molten aluminum. Applications include launders, troughs, spouts, tap-out blocks and stoppers and pyrometer tubes. Special uses are found in furnaces subject to intermittent operation. ALFRAX® *fused alumina bubble insulating brick* are light in weight, withstand high temperatures and have the low heat transfer qualities needed in walls and roofs above the metal line. MULLFRAX® *electric furnace mullite* offers resistance to flame erosion and spalling plus low heat conductivity. It is widely used for burner blocks.

For assistance and recommendations on how to engineer refractories to your specific furnace needs, contact Dept. R-40, Refractories Div., Carborundum Co., Perth Amboy, N. J. Phone: Hillcrest 2-3380.

For engineered refractories . . . count on

CARBORUNDUM®

Circle No. 16 on Reader Service Card

with

SPINCRAFT LADLES

Light, rugged, Spincraft ladles save replacement costs, make every pouring job easier! Available in a vast range of sizes, in stainless steel as well as mild.

•

LIGHT IN WEIGHT
LESS FATIGUE!

•

NON-SPILL SHAPE
NO WASTE!

•

EQUIPOISED HANDLE
BALANCED!

Write Today for Complete Data and Prices.

Spincraft
SKILL WILL DO IT
INCORPORATED

4138 WEST STATE STREET
MILWAUKEE 8, WISCONSIN
Division 2-0730

Circle No. 65 on Reader Service Card

PMM OPPORTUNITIES

jobs & equipment

Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding, 812 Huron Rd., Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

POSITIONS OPEN

Manufacturers agents seeks new lines: Die castings aluminum extrusion. Will consider other allied lines. Long established live wire organization headquarters in New York covering O.E.M. and other accounts eastern area, exclusive basis only. Give complete details. Box 4160.

National Die Casting is on the Move! ENGINEERS WANTED—Completely modern plant, recently expanded, puts National Die Casting among the leaders in the industry. We are now choosing key men to implement this growth. We are interested only in experienced well-grounded men to fill these jobs. Sales Engineers—3; Industrial Engineers—2; Estimator—1; Die-Casting Specialist—1; Die Layout Engineer—experienced; Methods Engineer, Product Designer. We specialize in aluminum and zinc in the 400 to 800 ton range. Call Mr. Pavlis, HOllycourt 5-6000, for an appointment. Or write giving your background and experience. National Die Casting Co., 3635 W. Touhy Ave., Chicago 45, Ill.

Growing Powdered Metal Fabricator wants tool and production engineers with powdered metal experience. Attractive salary commensurate with ability and background. Our employees know about this ad. American Powdered Metals, Inc., P.O. Box 217, North Haven, Conn.

FOR SALE

FOR SALE—REBUILT DIE CASTING MACHINES—Cleveland 400 Al; Lester Ph. 600 Al, Zn; Lake Erie 300 Zn; Ternstedt 150 Zn. Send for list—Contract Rebuilding too. Die Cast Machinery Inc., 409 Earl St., Toledo 5, Ohio.

Reed-Prentice Zinc die casting machine 1½ serial #40116. This machine is in good condition and can be seen in operation. Sacrifice price $5,000. Academy Die Casting & Plating Co., 58 First St., Newark, N.J., HUmbolt 2-1900.

SPECIFY

TIFFIN QUALITY

MELTING POTS

There is
A TIFFIN FOUNDRY Quality Melting Pot for all Non-ferrous Metal.

- IMMEDIATE DELIVERY on all standard size melting pots from stock.
- LONGER LIFE—The iron used in our melting pots is especially engineered for its heat and erosion resisting qualities. This means longer pot life.
- REAL ECONOMY—Pound for pound of melted metal, it costs less when you use Tiffin Foundry Quality Pots.
- SPECIAL POTS available. Send us your specifications.
- OVER 50 YEARS EXPERIENCE in the manufacture of quality pots and die equipment.

SPECIFY the pot with the trademark of quality — they are engineered to last.

DIES, PLUNGERS, NOZZLES & BAR STOCK ALSO AVAILABLE

Write today for complete information.

THE TIFFIN FOUNDRY, INC.
TIFFIN, OHIO

Circle No. 97 on Reader Service Card

DATA OFFERED IN THIS MONTH'S ADS

the Reader Service Cards facing the last page will get you these free reference materials. Circle the numbers and mail.

1. **Die Casting Machines**—ABC Die Casting Machine Co.—12-page catalog—gives specifications on air and hydraulically operated die casting machines from 16 to 600 tons.

6. **Tool Steels**—Allegheny Ludlum Steel Corp.—Publication list—describes 125 technical publications available on tool steels.

11. **Piston Rings**—Auto-Diesel Piston Ring Co.—Catalog lists plunger rings, tips, liners and combination tip-rings.

13. **Sinterings**—Bunting Brass and Bronze Co.—Engineering handbook—on the designing and production of sintered metal parts.

15. **Investment Cast 17-4PH**—Cannon-Muskegon Corp.—ICI technical research report—on the effect of aging time and temperature on the mechanical properties of investment cast 17-4PH.

17. **Fire Resistant Fluids**—Celanese Chemical Co.—Information—tells how Cellulube fire resistant hydraulic fluids provide both safety and lubrication.

21. **Glass Cores**—Corning Glass Works—Technical data—on glass tubing for coring high tolerance holes in castings.

25. **Standardized Die Components**—Detroit Mold Engineering Corp.—170-page catalog—describes standardized die components which reduce design time and cut die construction costs.

26. **Plunger Lubricant**—Die Casting "ID" Corp.—Technical information—on Plunger Lube #400 for die casting machine plungers.

30. **Die Castings**—Dollin Corp.—16-page facilities brochure—describes and illustrates die casting services, facilities and equipment.

31. **Sintering Furnaces**—Electric Furnace Co.—20-page brochure—illustrates and describes a line of sintering furnaces and their applications.

33. **Tool & Die**—Gentry Carbide Tool & Die Co.—6-page facilities brochure—shows their equipment for making carbide tools and dies.

34. **Metal Powder**—The Glidden Co.—Technical literature—describes the Resistox Metal Powders that are prepared by a special process which removes all soluble salts.

35. **Small Die Castings**—Gries Reproducer Corp.—Technical data—on small zinc alloy die castings.

36. **Sintering Furnaces**—Harper Electric Furnace Corp.—Engineering data—on tube, pusher, box and mesh belt type sintering furnaces.

37. **Zinc Alloys**—Henning Bros. & Smith, Inc.—Technical booklet—includes production and design data on Zamak zinc alloys for die castings.

38. **Investment Casting**—Hitchiner Mfg. Co.—13-page booklet—explains the ceramic shell investment casting process and shows Hitchiner's facilities.

46. **Powdered Metal Presses**—Kux Machine Co.—Catalog—describes a complete line of powdered metal compacting presses.

48. **Induction Heating**—Lepel High Frequency Laboratories—Catalog—describes line of high frequency induction heating units.

49. **Die Castings**—Lester-Phoenix, Inc.—Technical bulletin—gives complete specifications on die casting machines with locking pressures of 100 to 1600 tons.

55. **Die Castings**—New Jersey Zinc Co.—Booklet—"The End Uses of Zinc Die Casting."

56. **Sinterings**—New Jersey Zinc Co.—Technical booklet—tells how to design for pressed brass and nickel silver metal powder parts.

57. **Sinterings**—Norwalk Powdered Metals Inc.—Technical brochure—"Converting Powdered Metal into Machine Parts."

58. **Iron Powder**—Pyron Corp.—Technical brochure—on hydrogen reduced iron powders.

59. **Trim Presses**—Hannifin Co.—Technical literature—gives specifications and advantages of open gap or column type trimming presses.

60. **Lubricants**—M. W. Parsons-Plymouth, Inc.—Technical literature—describes lubricants that reduce molding and ejection pressures for powdered metal molding.

62. **Sintering**—Reese Metal Products Corp.—Technical report—"How to Cut Costs With The Remet Powdered Metals Process."

63. **Metal Powders**—Republic Steel Corp.—Technical bulletins—describe CDF, MS and HS6460 metal powders.

65. **Ladles & Skimmers**—Spincraft, Inc.—Technical data—and prices on stainless steel ladles and skimmers.

69. **Brass Die Castings**—Titan Metal Mfg. Co.—Brochure—discusses the use of pressure brass die castings for cored parts with thin sections.

72. **Steel Finishing Balls**—Abbott Ball Co.—Technical bulletin AP-1—describes barrel finishing media for producing mirror-like finishing.

73. **Corrosion Protection**—Allied Research Products, Inc.—Technical manuals—tell about chromate conversion coatings and clear protective coatings.

74. **Drilling & Tapping**—Ettco Machine & Tool Co.—Catalog—describes multiple spindle heads for drilling or tapping on any drill press.

76. **Vibratory Finishing**—Roto-Finish Inc.—Technical booklet—describes the Vibraton for precise finishing of castings.

84. **Refractory Mold Materials**—Harbison-Walker Refractories Co.—Technical literature—describes Calamo for investment molds and H-W Flintgrain for ceramic shell molds.

89. **Sinterings**—Crane Metals Div.—Technical reports—based on case histories show how iron powdered metals reduce product costs.

90. **Die Castings**—American Smelting & Ref. Co.—Technical information—on electrolytically refined high grade zinc and other alloys for die casting.

91. **Tooling Plastics**—Furane Plastics Inc.—8-page technical booklet—gives complete information on the use of Epocast plastics for foundry tooling and patternmaking.

93. **Sinterings**—Carbon City Products Co.—4-page brochure—discusses some of the advantages and applications for sinterings.

94. **Nickel Powders**—Sherritt Gordon Mines—Technical information—on high purity nickel powders includes prices and delivery information.

95. **Steel Sinterings**—Globe Industries, Inc.—Technical literature—on the use of steel sinterings for parts requiring high strength and intricate shapes.

96. **Sintering Furnaces**—C. I. Hayes, Inc.—Technical data—on a line of atmosphere and vacuum sintering furnaces.

97. **Melting Pots**—Tiffin Foundry Inc.—Literature—describes a complete line of standard size quality melting pots for every non-ferrous melting operation.

98. **Sinterings**—Brockway Pressed Metals Inc.—Technical bulletin—gives design information and properties for "Self-Lubricating" metal parts.

"the HITCHINER way..."

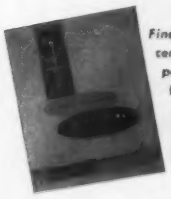
cut costs two-thirds by INVESTMENT CASTING

These roller mounts, used on a precision skin-grafting machine, guide rollers which regulate the depth of the skin graft. The material used must withstand the high temperature of sterilizing and the corrosive elements of human blood.

The user of these stainless steel roller mounts once thought they could only be made by machining of stainless steel bar stock. Hitchiner's "Engineered Quotation" showed they could be investment cast, not only in the necessary alloy and without design changes, but with considerable savings.

The use of investment casting meant five times greater production without highly-skilled labor, a one-per-thousand reject rate, and a per unit cost of a third that of machined parts.

This wide freedom of choice in alloy, as well as flexibility in design may help you with your parts manufacturing problems. Try "the Hitchiner way" yourself and send us a sample or blueprint for our "engineered quotation" — no obligation.



Find out how our new ceramic shell technique can possibly benefit you. Send for our free, new revised brochure on the latest investment casting methods.

HITCHINER
MANUFACTURING COMPANY INC.
MILFORD 24, NEW HAMPSHIRE

Coast to Coast Engineering Representatives

Circle No. 38 on Reader Service Card

99. Sinterings—Merriman Bros., Inc.—Catalog—and technical information on powdered metal helical gears and other structural parts.

102. Sintering Furnaces—Lindberg Engineering Co.—Technical information—on a line of sintering and brazing furnaces and atmosphere generators.

103. Investment Castings—Humphrey Castings, Inc.—34-page technical booklet—and facilities brochure explains the investment casting process and shows some of its advantages and applications.

104. Sinterings—International Powder Metallurgy Co.—28-page technical booklet—is a guide for designing sinterings.

106. Extrusion Tool Steels—Latrobe Steel Co.—Technical literature on a line of steels for extrusion dies.

107. Sinterings—Haller Inc.—Technical information—on presses, furnaces, test specimen dies, and other equipment for the production of sinterings.

ALUMINUM EXTRUSIONS, INC. ESTABLISHES "CHAIR IN EDUCATIONAL TELEVISION"

The country's first Chair in Educational Television was established today by Aluminum Extrusions, Inc., of Charlotte, Mich.

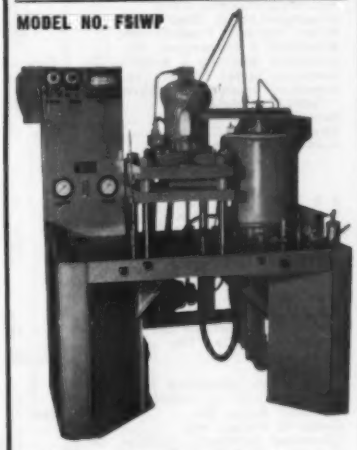
William E. Dunlap, AE president, said that the Aluminum Extrusions Chair in Educational Television would take the form of a series of programs specially-produced by AE, plus programs of cultural and public affairs significance originally telecast by the commercial networks, but now stored in their archives. These programs will be donated by AE to educational television stations.

The specially-produced shows will focus on the importance of distinguished architecture and design, and on the future of the American Main Street. The architecture and design program will feature Minoru Yamasaki, architect, of Detroit; Richard S. Latham, industrial designer, of Chicago; and George Nelson, architect and industrial designer, of New York. The Main Street program will feature Mr. Nelson, whose office, George Nelson and Company, Inc., of New York designed the U.S. exhibition in Moscow last year.

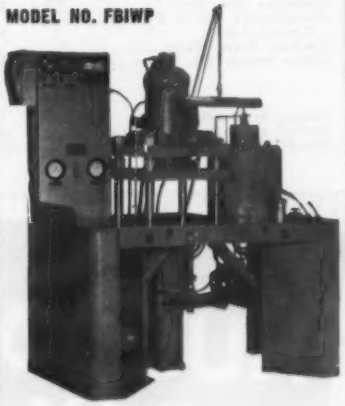
The series is designed to be telecast during prime evening hours in a one-week period in late spring or in early autumn.

NEW
3½ lbs. WAX CAPACITY ON STANDARD MODEL #FSIWP

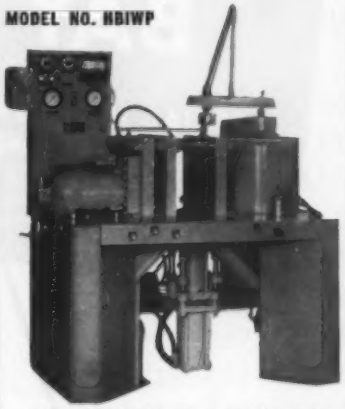
MODEL NO. FSIWP



MODEL NO. FBIWP



MODEL NO. HBIWP



For complete details write direct to Leyden Hydraulics

Any Type or Size Unit Built to Your Specifications.

LEYDEN HYDRAULICS, INC.
1800 North River Rd. • Melrose Park, Ill.

INDEX OF ADVERTISERS

A

A.B.C. Die Casting Machine Co. 88
Abbott Ball Co., The 60
Acromark Co., The 19
Advance Tool & Die Casting Co., Inc. ...100
Ajax-Magnethermic Corp. 20
Allegheny-Ludlum Steel Corp. 12
Allied Research Products, Inc. 57
Aluminum & Magnesium, Inc. 2
Aluminum Smelting & Refining Co. ..Cov. II
American Metal Climax, Inc. 89
American Smelting & Refining Co.
Federated Metals Div. 29
American Zinc Sales Co. 15
Apex Smelting Co. .....Cov. IV
Auto-Diesel Piston Ring Co. 4

B

B & T Machinery Co. 41
Baldwin-Lima-Hamilton Corp.
Industrial Equipment Div. 72
Brockway Pressed Metals, Inc. 99
Bunting Brass & Bronze Co. 71

C

Cannon-Muskegon Corp. 5
Carbon City Products Co., Inc. 93
Carborundum Co., The
Refractories Div. 104
Cast-Master
H-P-M Div., Koehring Co. 1
Celanese Corp. of America 11
Certified Alloys Co. .....Cov. II
Clapp & Poliak, Inc. 17
Cleveland Automatic Machine Co. 69
Columbia Tool Steel Co. 83
Consolidated Mining & Smelting Co. of
Canada Ltd. 95
Corning Glass Works 8
Crane Metals Div. 92

D

Design Engineering Show 17
Detroit Mold Engineering Co. 100
Die Casting "ID" Corp. 102
Diecraft Tool Co. 102
DiSalle Plating & Die Casting Co. 97
Joseph Dixon Crucible Co., The 16
Dollin Corp. 9

E

Electric Furnace Co., The 96
Ettco Machine & Tool Co. 101

F

Ferro Powdered Metals, Inc. 94
Furane Plastics, Inc. 102

G

Gantry Carbide Tool & Die Co., Inc. 80
Glidden Company, The 68
Globe Industries, Inc. 83
Grav-i-Flo Corp. 58
Gries Reproducer Corp. 93

H

Haller, Inc. 75
Hannifin Co.
A Div. of Parker-Hannifin Corp. 90
Hardy, Charles, Inc. 74
Harbison-Walker Refractories Co. 23
Harper Electric Furnace Co. 87
C. I. Hayes, Inc. 91
Henning Bros. & Smith 103
Hitchiner Mfg. Co. 107
Hoeganaes Sponge Iron Corp. 81
Hoover Co., The .....Cov. III
Humphrey Castings, Inc. 62
Hydraulic Press Mfg. Co.
Div. Koehring Co. 1

I

Indussa Corporation 99
Industrial Equipment Div.
Baldwin-Lima-Hamilton Corp. 72
International Minerals & Metals Corp. ...108
International Powder Metallurgy Co. 88

J

A. Johnson & Co. 67

K

Kaiser Aluminum & Chemical Corp. 18-19
Kerr Mfg. Co. 60
Keystone Carbon Co. 82
Kux Machine Co. 51

L

Latrobe Die Casting Co. 13
Latrobe Steel Company 61
Lepel High Frequency Laboratories, Inc. .. 62
Lester-Phoenix, Inc. 6-7
Leyden Hydraulics, Inc. 107
Lindberg Engineering Co. 84-85

M

Merriman Bros., Inc. 83
Metals Disintegrating Co. 64
Metal Powders, Inc. 101
Milwaukee Die Casting Co. 4
Misco Precision Casting Co. 25
Mt. Vernon Die Casting Co. 21

N

New England Die Casting Co. 30
New Jersey Zinc Co., The 22, 75
Norwalk Powdered Metals, Inc. 80

P

Parker-Hannifin Corp. 90
Parsons-Plymouth, M. W. Inc. 73
Pyron Corp. 73

R

Reed-Prentice Corp. 28
Reese Metal Products Corp. 74
Republic Steel Corp. 78-79
Roto-Finish, Inc. 54

S

Sherritt Gordon Mines Ltd. 98
Southwestern Graphite Co. 66
Spincraft, Inc. 105
St. Joseph Lead Co. 26
Sterling Engineering 93
Stroh Die Casting Co., Inc. 101

T

Tiffin Foundry, Inc. 105
Titan Metal Mfg. Co. 52
A. Triulzi 48

U

U. S. Bronze Powder Works, Inc. 86

V

Vanadium-Alloys Steel Co. 76

HUDSON BAY

SPECIAL HIGH GRADE ZINC — 99.99%

International Minerals and Metals Corp.

11 Broadway
New York 4, N.Y.

One Fine Zinc For Die Casting

Circle No. 101 on Reader Service Card

READER SERVICE CARD...

PMM

To receive any of the free literature listed in this issue tear out a reader service card and circle the proper numbers.

BE SURE YOUR NAME, ADDRESS, COMPANY NAME, & JOB TITLE ARE LEGIBLE.

PLEASE PRINT

APRIL 1960, DO NOT USE AFTER 7-15-60

Name ..... Position .....

Company ..... Kind of Business .....

Street .....

City ..... Zone ..... State .....

Please send me additional information and literature on items circled below.

1	19	37	55	73	91	109	127	145	163	181	199	217	235	253	271	289	307	325	343	361	379	397
2	20	38	56	74	92	110	128	146	164	182	200	218	236	254	272	290	308	326	344	362	380	398
3	21	39	57	75	93	111	129	147	165	183	201	219	237	255	273	291	309	327	345	363	381	399
4	22	40	58	76	94	112	130	148	166	184	202	220	238	256	274	292	310	328	346	364	382	400
5	23	41	59	77	95	113	131	149	167	185	203	221	239	257	275	293	311	329	347	365	383	401
6	24	42	60	78	96	114	132	150	168	186	204	222	240	258	276	294	312	330	348	366	384	402
7	25	43	61	79	97	115	133	151	169	187	205	223	241	259	277	295	313	331	349	367	385	403
8	26	44	62	80	98	116	134	152	170	188	206	224	242	260	278	296	314	332	350	368	386	404
9	27	45	63	81	99	117	135	153	171	189	207	225	243	261	279	297	315	333	351	369	387	405
10	28	46	64	82	100	118	136	154	172	190	208	226	244	262	280	298	316	334	352	370	388	406
11	29	47	65	83	101	119	137	155	173	191	209	227	245	263	281	299	317	335	353	371	389	407
12	30	48	66	84	102	120	138	156	174	192	210	228	246	264	282	300	318	336	354	372	390	408
13	31	49	67	85	103	121	139	157	175	193	211	229	247	265	283	301	319	337	355	373	391	409
14	32	50	68	86	104	122	140	158	176	194	212	230	248	266	284	302	320	338	356	374	392	410
15	33	51	69	87	105	123	141	159	177	195	213	231	249	267	285	303	321	339	357	375	393	411
16	34	52	70	88	106	124	142	160	178	196	214	232	250	268	286	304	322	340	358	376	394	412
17	35	53	71	89	107	125	143	161	179	197	215	233	251	269	287	305	323	341	359	377	395	413
18	36	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360	378	396	414

PLEASE PRINT

APRIL 1960, DO NOT USE AFTER 7-15-60

Name ..... Position .....

Company ..... Kind of Business .....

Street .....

City ..... Zone ..... State .....

Please send me additional information and literature on items circled below.

1	19	37	55	73	91	109	127	145	163	181	199	217	235	253	271	289	307	325	343	361	379	397
2	20	38	56	74	92	110	128	146	164	182	200	218	236	254	272	290	308	326	344	362	380	398
3	21	39	57	75	93	111	129	147	165	183	201	219	237	255	273	291	309	327	345	363	381	399
4	22	40	58	76	94	112	130	148	166	184	202	220	238	256	274	292	310	328	346	364	382	400
5	23	41	59	77	95	113	131	149	167	185	203	221	239	257	275	293	311	329	347	365	383	401
6	24	42	60	78	96	114	132	150	168	186	204	222	240	258	276	294	312	330	348	366	384	402
7	25	43	61	79	97	115	133	151	169	187	205	223	241	259	277	295	313	331	349	367	385	403
8	26	44	62	80	98	116	134	152	170	188	206	224	242	260	278	296	314	332	350	368	386	404
9	27	45	63	81	99	117	135	153	171	189	207	225	243	261	279	297	315	333	351	369	387	405
10	28	46	64	82	100	118	136	154	172	190	208	226	244	262	280	298	316	334	352	370	388	406
11	29	47	65	83	101	119	137	155	173	191	209	227	245	263	281	299	317	335	353	371	389	407
12	30	48	66	84	102	120	138	156	174	192	210	228	246	264	282	300	318	336	354	372	390	408
13	31	49	67	85	103	121	139	157	175	193	211	229	247	265	283	301	319	337	355	373	391	409
14	32	50	68	86	104	122	140	158	176	194	212	230	248	266	284	302	320	338	356	374	392	410
15	33	51	69	87	105	123	141	159	177	195	213	231	249	267	285	303	321	339	357	375	393	411
16	34	52	70	88	106	124	142	160	178	196	214	232	250	268	286	304	322	340	358	376	394	412
17	35	53	71	89	107	125	143	161	179	197	215	233	251	269	287	305	323	341	359	377	395	413
18	36	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360	378	396	414

PLEASE PRINT

APRIL 1960. DO NOT USE AFTER 7-15-60

Name ..... Position .....

Company ..... Kind of Business .....

Street .....

City ..... Zone ..... State .....

Please send me additional information and literature on items circled below.

1	19	37	55	73	91	109	127	145	163	181	199	217	235	253	271	289	307	325	343	361	379	397
2	20	38	56	74	92	110	128	146	164	182	200	218	236	254	272	290	308	326	344	362	380	398
3	21	39	57	75	93	111	129	147	165	183	201	219	237	255	273	291	309	327	345	363	381	399
4	22	40	58	76	94	112	130	148	166	184	202	220	238	256	274	292	310	328	346	364	382	400
5	23	41	59	77	95	113	131	149	167	185	203	221	239	257	275	293	311	329	347	365	383	401
6	24	42	60	78	96	114	132	150	168	186	204	222	240	258	276	294	312	330	348	366	384	402
7	25	43	61	79	97	115	133	151	169	187	205	223	241	259	277	295	313	331	349	367	385	403
8	26	44	62	80	98	116	134	152	170	188	206	224	242	260	278	296	314	332	350	368	386	404
9	27	45	63	81	99	117	135	153	171	189	207	225	243	261	279	297	315	333	351	369	387	405
10	28	46	64	82	100	118	136	154	172	190	208	226	244	262	280	298	316	334	352	370	388	406
11	29	47	65	83	101	119	137	155	173	191	209	227	245	263	281	299	317	335	353	371	389	407
12	30	48	66	84	102	120	138	156	174	192	210	228	246	264	282	300	318	336	354	372	390	408
13	31	49	67	85	103	121	139	157	175	193	211	229	247	265	283	301	319	337	355	373	391	409
14	32	50	68	86	104	122	140	158	176	194	212	230	248	266	284	302	320	338	356	374	392	410
15	33	51	69	87	105	123	141	159	177	195	213	231	249	267	285	303	321	339	357	375	393	411
16	34	52	70	88	106	124	142	160	178	196	214	232	250	268	286	304	322	340	358	376	394	412
17	35	53	71	89	107	125	143	161	179	197	215	233	251	269	287	305	323	341	359	377	395	413
18	36	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360	378	396	414

THE FOLLOWING WOULD LIKE TO GET PMM EACH MONTH:

DO NOT WRITE IN THESE SPACES

P 1
JOB
SIC
P 2
P 3
PER

Name _____ Position _____

Name _____ Position _____

Company _____

Address _____

_____

Major Products made at this address: _____

THIS PLANT (USES) (PRODUCES) ☐ ☐ TYPES OF PARTS CHECKED BELOW:

- ☐ Die Castings
- ☐ Extrusions
- ☐ Investment Castings
- ☐ Powder Metal Parts
- ☐ Permanent Mold Castings
- ☐ Plaster Mold Castings
- ☐ Shell Mold Castings
- ☐ None of these

PMM

READER SERVICE CARD...

To receive any of the free literature listed in this issue tear out a reader service card and circle the proper numbers.

BE SURE YOUR NAME, ADDRESS, COMPANY NAME, & JOB TITLE ARE LEGIBLE.

FIRST CLASS
PERMIT No. 8066
CLEVELAND, OHIO

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY: *Reader Service Department*

Precision Metal Molding
812 Huron Road
Cleveland 15, Ohio

FIRST CLASS
PERMIT No. 8066
CLEVELAND, OHIO

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY: *Reader Service Department*

Precision Metal Molding
812 Huron Road
Cleveland 15, Ohio

FIRST CLASS
PERMIT No. 8066
CLEVELAND, OHIO

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY: *Reader Service Department*

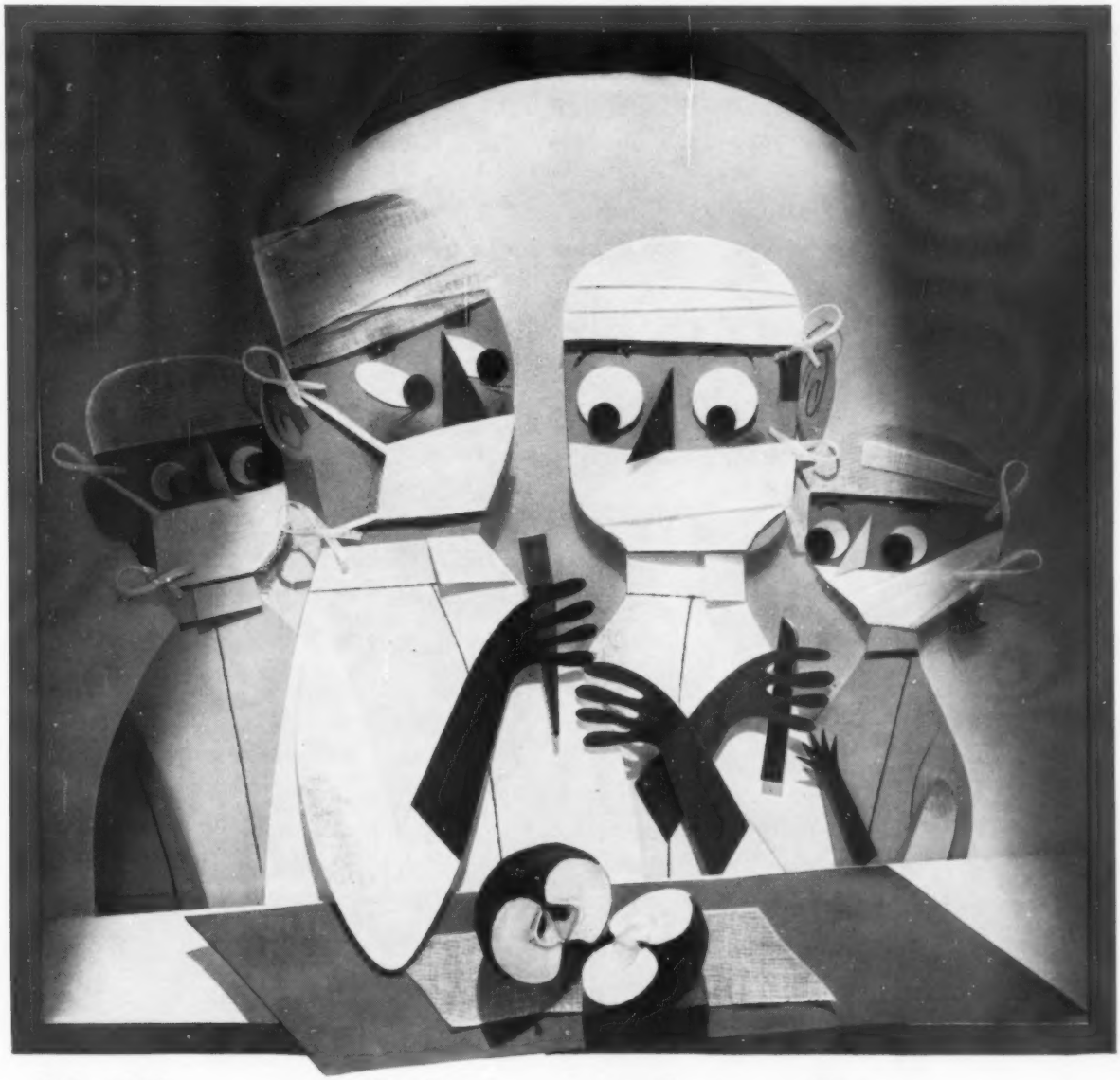
Precision Metal Molding
812 Huron Road
Cleveland 15, Ohio

FIRST CLASS
PERMIT No. 8066
CLEVELAND, OHIO

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY: *Reader Service Department*

Precision Metal Molding
812 Huron Road
Cleveland 15, Ohio



If it's precision you're after,

call a Hoover Man

Some people are exacting about everything they do. Precisely the way we feel about Hoover castings—aluminum and zinc alloy ones, that is. We've been producing precision castings for virtually every major industry in the country for 35 years. Why not try us out? Just get in touch with us and let one of our Sales Engineers give you the whole story.

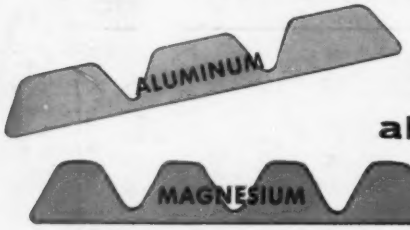
THE HOOVER COMPANY
Die-Casting Division
North Canton, Ohio In Canada — Hamilton, Ontario

Die Casting specialists since 1922

DIE CASTING *by* HOOVER

Circle No. 40 on Reader Service Card

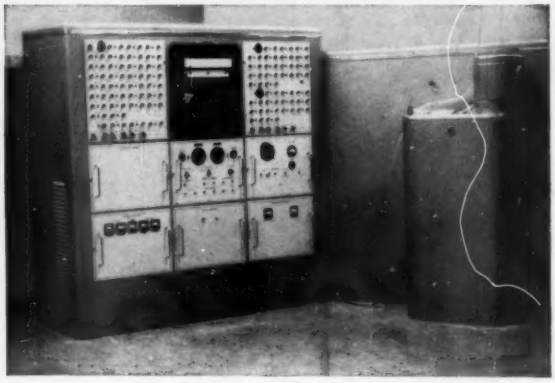
ALLOY INGOT FOR SAND, PERMANENT MOLD AND DIE CASTING



How APEX Production Control produces alloys tailored to your specifications with certified accuracy

Your specification page in the Apex Spec Book controls your ingot production—holding alloy elements to desired content for castability and maximum properties.

Once recorded, your particular specs become the formula for your alloy production in all Apex plants. Under meticulous control, you receive an alloy to meet casting applications requiring special mechanical properties, physical properties, machinability, corrosion resistance or other individual needs. The Spec Book also includes specifications for all standard alloys conforming to governmental and society specifications.



The QUANTOMETER assures you of an alloy conforming to your specifications

Our sales engineers will gladly discuss the Apex production control system as it applies to your casting requirements. Call on us now for composition accuracy and prompt shipment of your alloys.

Circle No. 10 on Reader Service Card

APEX SMELTING COMPANY

CHICAGO 12 • CLEVELAND 5 • LONG BEACH 10, CAL.
SPRINGFIELD, OREGON (NATIONAL METALLURGICAL CORP.)
Warehouse distributor of ALCAN foundry alloy ingot

Base metal and alloy SPECTROGRAPHIC STANDARDS available · Aluminum · Magnesium · Zinc